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THE GOD OR THE IDOL

THE chief merit of Mr. L. T. Minchin's paper on 'Gas Quality and Appliance Performance,' published on pp. 650-665 of this issue of the *Journal*, apart from its high intrinsic excellence, was that it provided an illuminating discussion among his fellow scientists. They at least brought it down to earth. He protested that 'the old Gas Acts'—surely he meant the new ones, though not, of course, the newest of all—had set up the calorimeter as a new god which it became one of the engineers' duties to propitiate. Mr. A. Forshaw countered that one by pointing out in the first place that the calorimeter was a very much juster god than its predecessor, the sperm candle, and by expressing a healthy doubt whether Mr. Minchin's proposed new idol, 'a mere numerical expression and not additive for mixtures' could fulfil the practical function of providing a measure of the useful quantity of energy sold over the counter. A *sotto voce* remark, heard off, was that one would hate to have to buy a Wobbe of gas! But joking apart it was very useful to have the utility and standing of the Wobbe index well ventilated, because these are exercising the minds not only of British research workers and distribution engineers, but those of their opposite numbers on the Continent. We have yet to run into difficulties of the magnitude encountered in France, for example, and to a vastly greater extent in North America, where gases are distributed with calorific values and compositions varying over much wider limits than we have to deal with.

And that brings us to what seemed to be the main defect of the paper. It took a rather dismal view of the adaptability of appliances to such changes as are inevitable in gas quality and it might with advantage have attempted to show to what caprices of the new idol existing appliances could adapt themselves. After all, the Wobbe index is directly as the calorific value and inversely as the root of the specific gravity, so that as in any given case the C.V. is as constant as practicable it comes down to keeping the specific gravity within a suitable tolerance. What is a suitable tolerance? What is the necessary limit? The Final Report, GRB34, on Combustion Characteristics stated that 'some undertakings are maintaining the specific gravity of their town gas within 10% of its mean value, but (that) control within closer limits would be accompanied by considerable technical difficulty.' Would such a tolerance pacify Mr. Minchin? Mr. G. H. Fuidge made the point, and Mr. Forshaw confirmed it, that as a matter of fact appliances were pretty tolerant to changes in combustion characteristics and did not demand gas of quite constant quality. In practice, variations of pressure, especially deficiency of pressure, give far more trouble than the usual variations in other physical properties. That is not to say, of course, that the gas engineer should not issue gas of as constant a composition as economics and the necessities of his business allow. But that is not to say either that we should be wise in copying the Continental example to the extent of standardising calorific value and specific gravity over the whole country. It is to be hoped that under the new dispensation the 'stupid' chaos of 26 different standards, often with meaningless differences, will be reduced to order. Mr. Forshaw's Company has already found it practicable to ignore this 'chaos' and to divide the calorific range into four classes differing by 30 B.Th.U. and such a classification should be quite fine enough for all reasonable purposes. The main purpose of a reasonable latitude in the choice of calorific value is, of course, to allow for the differences in the coals economically available in the several regions and in the plant available for treating them. We must adhere firmly to our hard won liberty in this matter while exercising it in reason and with restraint.

Mr. Mills' contribution to the discussion was equally forthright and refreshing. We were attracted by, among others of his remarks, his very well justified claim that 'considering that they (*i.e.*, the Gas Light and Coke Company's undertakings) had been literally bombed to blazes and were now sending out 20% more gas than in 1938' (a very large increase for so great an undertaking) they were not doing so badly, and by his description of the flame matching burner which the fitter could carry in his waistcoat pocket and by which he could adjust the appliance by simply matching the flame of the appliance against the flame of the matching burner.

There is much more of interest but no doubt Dr. King adequately summed up the paper by dividing it into two parts. The first called for more work on combustion research to which no one will object. The second called

for greater uniformity in the kind of gas produced. This might be qualified on the lines of GRB34 which expressed the more practical view that as various diluents have different effects on the mixed town gas it was important that any one works should adopt a uniform method of attaining the declared calorific value.

OUTLOOK IN FRANCE

THE friends of M. Baril in Britain will wish to congratulate him on his election to the Presidency of the Société des Ingènieurs Civils de France, a fitting acknowledgment of services rendered to the gas industry and to engineering generally in France during a long life spent mainly in the former. His predecessor in the Presidential Chair in a well-merited eulogy recounted how, beginning his working career in the ranks, M. Baril had risen quickly to high technical and administrative positions culminating in that of Joint Managing Director of the great Parisian Company, the Sté. d'Eclairage, Chauffage et Force Motrice. M. Baril's presidential address, of which we publish a brief abstract on pp. 648-649 of this issue, was mainly devoted to an appreciation of the 'importance' (the French word means a little more than that, including 'significance') of the gas industry in Western Europe, the U.S.A., and particularly in France. It is useful for us to compare the circumstances in which the industry operates in France with those of our own country. In the first place there is relatively little high grade gas coal below the French soil. The indigenous coal is rather of the coking variety, explaining the favour in which the coke oven is viewed by the French gas engineer. The relatively large quantity of coal which is imported compels him to look to alternatives, petroleum products, tail gases of oil refineries and to natural gas, of which useful deposits have been discovered mainly in the South West. It is probably due as much to this diversity of raw material as to the pressure of over-centralisation of control that we see the unfortunate, as it appears to us, tendency to restrict and standardise the properties of town gas.

The French technician applies himself to the task of determining the calorific value of town gas which will permit the production and distribution of gas calories at the minimum price, *i.e.*, the one figure to be applied to the whole country—an impossible task. That it is impossible is shown by the wide limits arrived at by M. Baril and the careful qualifications with which his conclusion is hedged. 'There is a certain range within which each undertaking, *taking its local circumstances into consideration*, will be able to choose the most economically desirable calorific value.' His range is from 400 to 500 B.Th.U./cu.ft.—as wide as that—and he argues for liberty to select and change the adopted value, adapting it to changing economic (and we hope, technical) conditions.

While not going to the lengths of idolatry M. Baril is as interested as Mr. Minchin in the Wobbe index, the 'coefficient of afflux.' With regard to coal gas and its diluents, M. Baril uses this coefficient to show the inconveniences in domestic appliances which may result from using diluents of high density, such as producer gas. But above all the French engineer seems to be far more anxious than we are about the capacity of his distribution system. And we can sympathise with his despair of being able in any reasonable future to increase it. In the long run it would be a pity if technical development were to be hampered by the want of adequate means of distribution. At the same time M. Baril deprecates loading town gas with inerts, the presence of which, even in industrial appliances where flame temperature is the ruling factor, has a deleterious effect on thermal efficiency not fully, and not cheaply, counteracted by the use of recuperation.

It is, however, in the field of utilisation of other and richer gas that M. Baril chiefly applies the 'coefficient of afflux.' Much work has been put into these problems by M. Delbourg and others, to some of which we have referred from time to time in our feature 'Gas in France.' Perhaps the most interesting development of this work is M. Delbourg's production of a test burner which enables him to study and to foresee the behaviour of any gas in the domestic appliance. It is, of course, something more defined and of a much greater range than Mr. Mills' 'matching burner,' but there is something in common between them. Each is based on actual observation rather than theoretical inference.

But chiefly we sympathise with our French colleagues in their terrible struggle against the stranglehold of financial and economic difficulties. In our own industry each area board is encouraged, and indeed enjoined, to make its undertaking pay. It can charge prices which balance costs. But the French administrator is confronted with a Governmental restriction of the price he can charge—a price which at present is sufficient neither to balance costs nor to provide funds for maintenance and extensions. 'It is evidently not possible to pursue the development of a business which is selling at a loss.' In spite of this great handicap, M. Baril looks bravely to the future. 'The use of gas in France has not yet attained the stage of that in a number of other countries.' Very well then, he says: 'Its future development is possible. It can be effected by the employment of indigenous resources, it would result in an improvement in the national economy, it is a national duty!'

INSTITUTION'S HEADQUARTERS

EIGHTY-SEVEN years after its birth as the British Association of Gas Managers and 21 years after the grant of its Royal Charter as the Institution of Gas Engineers, the Institution will move next week from Gas Industry House to its *own* new headquarters at 17, Grosvenor Crescent, London, S.W.1. Early in 1948 the Council decided that steps must be taken to secure funds to enable the Institution to acquire its own headquarters, and in June of that year Dr. Harold Hartley, in his Presidential Address, said there had been nothing more heartening during his year of office than the permission granted by the Minister of Fuel and Power to the undertakings about to be nationalised to subscribe to the Headquarters Fund. On behalf of the members he thanked both the Minister and the members of his Department who had been so helpful. It was stipulated that the arrangements for acquiring and dealing with the fund must be acceptable to the Ministry and that evidence be provided that the members themselves really felt the need for the

Institution and would subscribe liberally. Some 60 members were approached privately and generous offers of help were received. Some of the leading gas undertakings and member firms of the Society of British Gas Industries were also approached, and in all promises of gifts totalling £60,000 (towards an ultimate target of £110,000) were received before the public appeal was launched. At the 1949 annual meeting Dr. Hartley was able to announce that the target had been passed and gifts and promises had reached a total of £112,897.

The new headquarters at 17, Grosvenor Crescent, to which the offices and library are being transferred during the coming week, are 100 yards from 1, Grosvenor Place, where the Institution was sub-tenant of the Gas Light and Coke Company for 12 years, and of the Gas Council since vesting date. The Grosvenor Crescent House suffered considerable war damage, as was evident from the photographs exhibited at the 1949 annual meeting of the Institution, but has now been restored and will afford attractive accommodation. The house has five floors and a basement and will accommodate the library, a reading room, visitors' waiting room, members' lounge, a council room and two committee rooms. The second and third floors will consist of administrative offices and the President's suite, and the fourth floor will form a caretaker's flat together with a staff rest room. The council room and smaller committee room are connected by folding doors and it is estimated that the two together will provide seating accommodation for 120. The Institution will still have to go to one or other of the sister Institutions for accommodation for its annual and autumn research meetings, but it should be possible for some of the District Sections and Junior Associations to meet at the new headquarters. Of late there has been a tendency for such meetings to be crowded out of Gas Industry House owing to the increasing number of meetings of the Gas Council and its various committees.

SOUNDING BRASS

DESCRIBING, year by year, the Ideal Home Exhibition is a more difficult task than might be supposed; one runs out of superlatives. On 27 occasions the promoters, the *Daily Mail*, have sought to provide the insatiable public with a series of spectacles of increasing magnitude and decreasing usefulness. This year eight and a half miles of aluminium tubing and 25,000 rivets have been utilised in the construction of a parabolic archway, 75 ft. in height, whose two tons of metal are poised on four steel pin-rollers, each only 1½ in. in diameter.

On a smaller scale, a similar determination to find new ideas has been shown by the designers of the gas exhibit, which has become increasingly complex through the years. The establishment of a high standard enforces a constant effort to improve upon it, and one is led to suspect that this effort becomes progressively more desperate. In this way there is danger that determination to produce a spectacle—any spectacle—may permit an increasing variation from the true purpose of the exhibit. It might be argued that the essential method employed is first to attract people to the stand (and for this purpose any method is legitimate), and then sell them the gas idea. Which is all very well if the bait is sufficiently tempting. If it is not, then the spectacle becomes redundant.

We wonder whether this has happened with the 'Treasure Island' sequence, to which reference has already been made in these columns, and which is described in some detail on pp. 643-644. This is, in our view, imperfectly publicised and could easily be overlooked altogether by the very casual visitor. That such an expensive piece of display work should be largely wasted is a serious matter, and it is to be hoped that some effort will be made to improve matters before the exhibition closes on April 1. Moreover, there would seem to be a certain weakness in giving a second adaptation of a Disney film, unless it was felt that the undoubted success of 'Alice in Thermland' justified another dose of the same kind of medicine.

There is another fault, purely technical in character, to be found in this series of tableaux. This concerns the lighting arrangements. In order to give maximum emphasis to the 'visions' of appliances which appear at the back of each scene, general lighting has suffered, and the result is perilously reminiscent of a rather seedy waxworks. Even so, this may not trouble young visitors, despite cinema-induced precocity. But we inspected the tableaux in solitary state, and there was no sign of other more eager visitors. General conditions on opening morning, particularly when there is a fog, are not conducive to good results, and we trusted that later, when things warmed up and adjustments had been made, this display received recognition worthy of the careful thought which went into its creation.

Alongside our competitors present the 'Palace of Electrical Ways,' which is tasteful and unpretentious, and concentrates on displaying appliances to the best advantage. Elsewhere in the exhibition there is no evidence of increasing electrical interest, and gas is remarkably well represented on many exhibits; over 30 gas appliances are shown in the model houses alone. It is, however, a melancholy fact that the number of gas appliance manufacturers exhibiting dwindles year by year. The reasons are easily guessed and are completely understandable, but we look forward to the day when greater freedom and improved selling conditions again make it economic for many of our old friends to be represented at the Ideal Home Exhibition, which is, when all is said and done, the biggest and best shop window in Britain.

INFORMATION PLEASE

THE first adjournment debate in the House of Commons, after the debate on the Address on March 6, proved to be a minor passage-of-arms between Mr. I. J. Pitman, M.P. for Bath, and Mr. Alfred Robens, Parliamentary Secretary to the Ministry of Fuel and Power. Mr. Pitman's specific charge was that the reason for the increased prices for gas in the south west, which had now been published, had not been divulged. The principles under which the area board was working, he added, included the fact that the price of gas had been put up in an area of supply not because the gas cost more, but because the price of gas in that area was before nationalisation 'the lowest in the whole area of the Gas Board.' There was also the principle that in the development of rural areas gas should be supplied at lower than cost, a subsidy being provided by increased charges in the urban areas. A further allegation referred to the fact that only 10 days' notice had been given of the new price tariff in the south western area, and that those 10 days were all after the consultative council had met

to consider the new tariff and not before, thus depriving the public of the right to make representations to the council. Mr. Pitman asked the Minister, therefore, to give directions both to the industry as a whole and particularly to the south west area that they should disclose all information. Mr. Robens replied that there might be many occasions, for example when they were dealing with matters of tariffs, when it was perhaps not in the public interest that the consultative council should make a disclosure. The Minister had gathered together in the South Western consultative council a good array, chosen quite impartially on the basis of public knowledge and public service with a duty laid on them. He understood what Mr. Pitman did not get was information in connection with the original price schedule which was subsequently withdrawn. The view of the consultative council was that there was no point in giving information about a schedule which had been withdrawn when the council was dealing with a schedule that was to be put into operation. It was Mr. Pitman's judgment against that of 23 people brought together from all walks of life and well versed in public life. 'It must be clear,' Mr. Robens added, 'that when a consultative council is set up for this specific purpose the hon. Member must accept the judgment of 23 people as to whether certain information should be given or not.'

Letter to the Editor

STRATEGY AND ECONOMY

DEAR SIR,—I would like to reply to some of the points raised in your editorial comments (*Journal*, March 1, pp. 513-514) on my recent paper. You state that you missed a reference to the development in Liverpool where three of the four works are worked as base load plant and fluctuations of load are taken up in the fourth. The position in Birmingham is very similar: we have four works producing about 9,000, 9,000, 6,000 and 2,000 mill. cu.ft. per annum respectively, and each works is equipped with base load coal gas plant and peak load carburetted water gas plant. The total annual makes of coal gas and carburetted water gas are approximately 21,000 and 5,000 mill. cu.ft. Transfer of gas from one district to another is easily arranged by adjustment of pressures of gas leaving each works, so that reduction in make at any works for any reason can be compensated by increased make at any other works. The whole of the *available* coal gas plant at all four works operates at full capacity all the time. Coal gas plant is never shut down or slowed down on account of seasonal demands, but the annual repairs to this plant are such that there is an all-the-year-round call for at least a little peak load gas. Each works is equipped with modern water gas plant to meet peak loads and this is preferable to having all the peak load plant at one works as this would involve transfer of coke.

With regard to my statement that increase in throughput in vertical retorts fundamentally increases the output, there is ample evidence in support of this statement. We have repeatedly found that increase in throughput associated with an increase in calorific value and a decrease in yield per ton gives a higher thermal yield per retort per day. The maximum calorific value obtainable in continuous vertical retorts depends on the class of coal available, but with mixtures of Midland and South Yorkshire gas coals, an average figure of 500 should be obtainable. In his paper to the Institution last November, Dr. Burns gave a figure of 536 B.Th.U. per cu.ft. for Yorkshire coals in continuous vertical retorts in London.

In my opinion the production of blue water gas in a continuous vertical retort is economical only up to the point of utilising residual heat in the coke; beyond this point it is an inefficient process involving external heating of the coke and higher consumption of coke as fuel per 1,000 cu.ft. than in an external blue water gas machine. Furthermore blue water gas production absorbs much more heat than coal gas production per therm, consequently production, beyond the optimum, of blue water gas in a continuous vertical retort by external heating necessitates a reduction in coal throughput and a lower output of gaseous therms per retort per day.

In your report of the discussion I am quoted as saying that when new oil refineries are in operation in this country, heavy oil would be as cheap as gas oil. I actually said that in these circumstances heavy oil might be much cheaper than gas oil, and its use for water gas manufacture may prove attractive.

Mr. Firth, in his letter in the *Journal* of March 1 (p. 517) states that I concluded that it is an unsound policy to wash for benzole. I dealt with the question of benzole extraction under the main heading 'Obtaining the maximum *gas* production from existing plant,' and I stated that the extraction of benzole from continuous vertical retort gas may lead to a loss of gaseous therms up to 16.5% per retort per day. The cessation of benzole extraction, therefore, gives an opportunity for obtaining more gas from existing carbonising plant. I inferred that benzole extraction may pay if there is a margin of carbonising plant capacity and a sale for extra coke, but that it would not pay if new carbonising plant had to be installed solely to enable benzole extraction to continue. When building a new works it may be policy to consider benzole extraction as in all probability there would then be a margin of carbonising plant capacity, at least for some years. I agree that benzole recovery has the advantage of reducing the organic sulphur content in the gas, but other processes are available for this purpose without extracting the benzole and thus reducing the gasmaking capacity of carbonising plant.

Yours faithfully,
S. K. HAWTHORN.
Divisional Engineer.

Birmingham and District Division,
West Midlands Gas Board.
March 9, 1950.

Personal

Mr. **R. W. L. Harris,** B.SC., M.I.C.E., M.I.MECH.E., M.I.E.E., will shortly retire from the post of Registrar and Secretary of the Professional Engineers Appointments Bureau, which he has held since the bureau started in 1945, to take up an appointment with the firm of Preece, Cardew, and Rider.

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Mr. **F. Firth,** who for nearly 32 years has held the position of Chief Chemist to the Leeds gas undertaking, has decided to retire at the end of this month. To mark the occasion a smoking concert is to be held in the Yorkshire Hussar, Leeds, on March 30, at 7.30 p.m., when a presentation will be made to Mr. Firth in recognition of his services. Many men in important positions in the gas industry owe some of their success to the help received from Mr. Firth and it is felt that if they should be in or near Leeds on that date they would like to join in honouring him.

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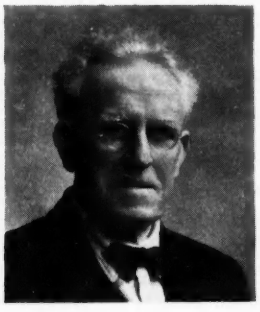
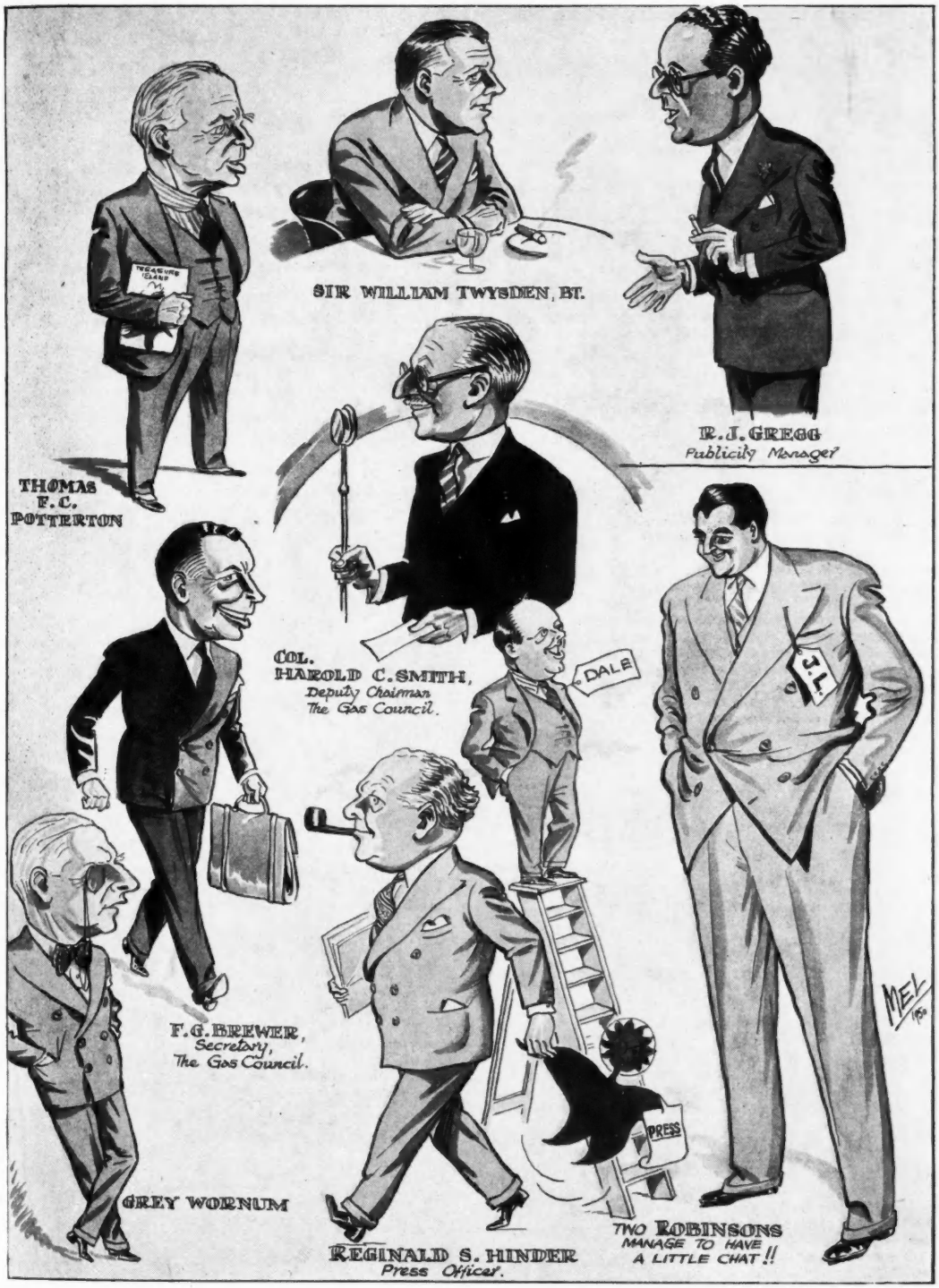
Mr. **James Francis Ronca,** O.B.E., A.R.C.S., A.R.I.C., A.M.I.MECH.E., HON.M.INST.GAS E., F.INST.F., has joined the Board of Directors of George Wilson Gas Meters, Ltd. As stated in the *Journal* of February 1, Mr. Ronca is taking up office as President of the Institute of Fuel in October. He studied at the Royal College of Science, South Kensington, from September, 1897, to midsummer, 1902, obtaining the Associateship (Chemistry) in midsummer, 1901. He was attached to the chief laboratory of the Associated Portland Cement Manufacturers at Gravesend until the end of 1903, and joined the examining staff of H.M. Patent Office early in 1904, remaining there until the outbreak of war in 1914, when he was transferred to Board of Trade headquarters. He served under Sir Percy Ashley in establishing what became the Department of Industries and Manufacture and in starting the operation of the Safeguarding and Industries Act, 1920, and became Director of Gas Administration under the Board of Trade and later the Ministry of Fuel and Power; he was appointed to succeed Dr. Haldane as one of the Gas Referees with Sir Charles Boys and Mr. W. J. A. Butterfield, and when Sir Ernest Smith joined the Ministry was associated with him in conducting a survey of industrial gas supplies and consumption, and in starting the fuel economy campaign. After the first war he was awarded the O.B.E., and on leaving the Ministry of Fuel and Power was complimented by the Institution of Gas Engineers by being made an Honorary Member. He is a Past-President of the Chemical Club, and President of the Royal College of Science Association. His hobbies are small mechanical work, microscopy, and reading.





We have pleasure in publishing these exclusive sketches drawn by the famous caricaturist, 'Mel,' at the pre-view of the Gas Council's 'Treasure Island' exhibit at the Ideal Home Exhibition, Olympia. A record number attended and showed keen interest in the colourful tableaux displayed and the many modern gas appliances included in the presentation.

North Eastern Party

Form Filling and Frustration

A SUCCESSFUL whist drive and dance for the employees of the York, Harrogate Group, North Eastern Gas Board, was held last week in the Royal Hall, Harrogate. Over 700 people attended this function, the first of its kind to be held since nationalisation. Incidentally, it was also the first time that employees attached to the various undertakings of the group had had the opportunity of joining together for such a social gathering.

An excellent programme was arranged by the committee, some 160 players taking part in the whist drive, while the rest of the company simultaneously enjoyed dancing. One of the highlights of the evening was the cabaret show held during the interval.

Members and officials of the North Eastern Gas Board present included the Chairman (Dr. R. S. Edwards) and Mrs. Edwards, Mr. A. McDonald (Member) and Mrs. McDonald, Mr J. C. Gardner (Secretary) and Mrs. Gardner, Mr. F. W. Allum (Chief Accountant) and Mrs. Allum. A number of group General Managers of the North Eastern Gas Board were also present including: Mr. N. C. Sturrock (York, Harrogate Group) and Mrs. Sturrock, Mr. N. G. Appleyard (Leeds Group) and Mrs. Appleyard, Mr. J. M. McLusky (Wakefield Group) and Mrs. McLusky, Mr. J. G. Tilley (Huddersfield-Halifax Group), Mr. L. W. Roberts (Grid) and Mrs. Roberts. Presentations of whist prizes were made by Mrs. Edwards, who was presented with a bouquet by Miss Burrows of Scarborough.

Mr. **N. C. Sturrock,** group General Manager, York, Harrogate Group, introduced the members of the Board to the company.

Mr. **McDonald** said it was a pleasure to be back among his former colleagues at Harrogate, especially to introduce Dr. Edwards, the Chairman of the Board. Since he left the York, Harrogate Group, they had seen the gradual development of the new organisation, whereby some 79 separate entities were being welded into one coherent whole. Some might wonder why there were so many questionnaires and so much paper work at the present time for which they could see no useful purpose. The board could not even begin the task of welding these units together until it knew the circumstances in each district, and it would be realised that for a short period they must ask questions. Members of the board were not unsympathetic to the amount of work involved. They had every sympathy, in fact Dr. Edwards had himself insisted that no unnecessary questions must be asked, but without the basic facts they could do very little of the task imposed upon them. There was no doubt that once they had all these facts, they could help to ease their burden, by striving after a certain amount of uniformity, but in doing so, he hoped they would never destroy the essential unity without which uniformity was useless. He looked forward to the time when all these initial enquiries would have been completed, so that managers, general managers, and board members could maintain contact with all employees, and so build up a feeling of partnership in the industry. Towards this end Dr. Edwards had hurried back from London to be with them. He had worked closely with him for the last ten months and could assure them that he was always willing, even at considerable sacrifice, to try to get to know the employees in the various districts.

Dr. **Edwards,** in a brief outline of the board and its activities, said that the North Eastern Board was the seventh largest of the area boards, serving 3 mill. people and covering a total area of approximately 1,400 sq. miles. The revenue was £10 mill. approximately, and the personnel in the region of 8,000. Stressing the importance of team spirit, Dr. Edwards said that a board could only be successful when everybody felt they had a key-part to do. The board's job was to plan the framework. Everybody counted in the expanding field of public service.

The hope was widely expressed that the function would become an annual event. The committee responsible for the arrangements comprised Mr. F. Ward (Harrogate), Mr. G. Howard (Harrogate), Mr. P. R. Brown (York) and Mr. N. A. Walker (Harrogate).

At the North Eastern Party at Harrogate. Left to right: Mr. A. McDonald, Mrs. F. W. Allum, Dr. Roger S. Edwards, Mrs. Edwards, Mr. N. C. Sturrock, and Mrs. Sturrock. Behind Dr. and Mrs. Edwards are Mr. N. A. Walker and Mr. F. Ward.

Glasgow Strike Ends

The following joint statement was issued on March 8 by Dr. A. B. Badger, Industrial Relations Officer of the Gas Council, and Mr. Hugh Kelly, General Secretary of the Plumbing Trades Union:

'Arising from discussions which have taken place at national level, between representatives of the Gas Council and of the Plumbing Trades Union, the Union's Executive Council has recommended the resumption of work at Glasgow on the understanding that negotiations will take place as soon as possible locally and nationally to discuss outstanding points.'

Our Glasgow correspondent reports that more than 240 gasfitters, who have been on strike for 18 weeks, returned to work on March 9 and almost 3,000 householders breathed sighs of relief. The workmen—members of the Plumbing Trades Union—were told on March 7 that the area board had agreed to consider their wage claims. Householders who have moved into new houses since November and have had to cook on open fires will be priority No. 1.

Glasgow's longest strike since the early 1920s was ended at a meeting between the union executive and the gas board. The board made only one condition—that the men return 'as soon as possible.' Since the strike began many conferences in Glasgow and London have ended in deadlock, but on March 7 a union official telephoned from London that the strikers had won their fight. A union official said: 'We will get the men back to work by Thursday and by working hard we should catch up with arrears of work.' During the dispute inspectors have been carrying out emergency maintenance, but thousands of families await installation of cookers and fires.

Total Production of coal for the week ended March 4 declined from 4,338,600 tons in the previous week to 4,327,400 tons. A further 300 men left the industry in the week ended February 25, including 200 face workers, reducing the total employed to 705,700, compared with 727,400 in the corresponding week last year. Gas available at gasworks in the week ended March 3 totalled 12,062.8 mill. cu.ft., against 11,577.5 mill. cu. ft. in the week before; comparative figures for electricity sent out over the same period show 1,098.5 mill. units, against 1,038.2 mill. in the previous week.

New World in a Georgian Mansion

Gas Serves the Needs of Women Students

OFFICIALLY opened by Princess Elizabeth, the Newton Park training college for women students of teaching in primary and secondary modern schools is situated in the charming village of Newton St. Loe, near Bath. This college, housed in a Georgian mansion, has been well adapted for college life by the architects, A. J. Taylor and Partners, of Bath.

Lovely outbuildings have been converted for use as lecture rooms, and a mediæval castle tower has now become the library.

Feeding arrangements for the students and staff present no difficulty, as the space allotted to the kitchen, servery, vegetable preparation room, and dining hall is all on one level, with an efficient plan of operation from the kitchen to the servery and from the servery to the new dining hall.

The kitchen itself is lofty, with long windows giving plenty of light. The walls are finished in a pastel shade of a restful colour, making ideal working conditions for the kitchen staff. The modern cooking equipment throughout was supplied by Radiation, Ltd., under the personal supervision of Mrs. Molly Gerrard, F.R.I.B.A., the architect.

In the main kitchen, where all the cooking is carried out, there are Chester ranges, a roasting oven, 30-gal. Lune boilers, Keswick steamers, and a Wardour fish-fryer, positioned to save unnecessary labour.

In the servery, which leads from the kitchen, there is a gas-heated service counter with a cold section and stainless steel top. For beverages, a tea and coffee set is placed conveniently at eye level.

Entrance to the Newton Park Training College, where gas mains have been laid and a complete gas-operated kitchen installation (pictured below) has been equipped by Radiation Ltd.—Architects: A. J. Taylor and Partners, Ltd.

Ingenious use has been made of the existing architecture to conceal an essential adjunct to the kitchen. An extract duct for ventilation has been placed in a decorative cupola on the roof, through which cooking odours from the kitchen are extracted. In this way, the symmetry of the roof line remains unspoiled.

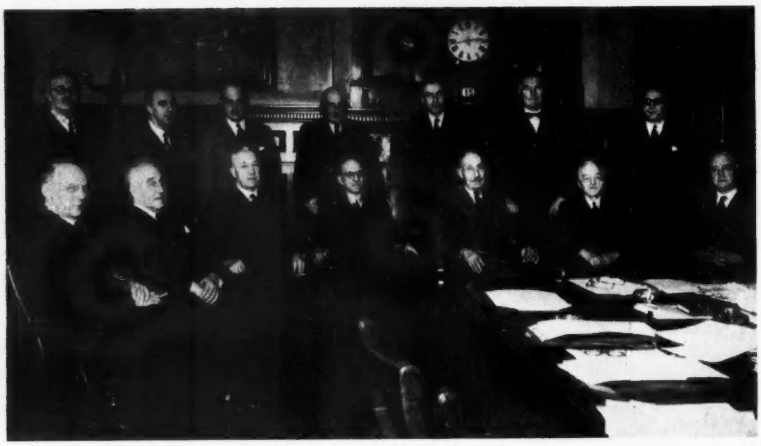
Prior to the installation of the kitchen, the Newton Park Training College had no gas supply. This has been installed by the Bath Sub-Division of the South Western Gas Board, who were responsible for main-laying and internal gas connection. It is now possible, therefore, to utilise gas, not only for cooking purposes, but for added comfort in the staff rooms, which have been fitted with Bratt Colbran 'Rayello' plaque gas fires.

Newton Park Training College is able to take 130 students, but plans are in progress for building study-bedrooms so that the number can be increased to 200. With the arrival of more students, the smooth running of the catering will maintain its present high level as allowance has been made, in planning the kitchens, to meet this possible expansion.

Our photograph, taken at the annual ball of the Athletic and Social Club of the Cardiff undertaking, records the first occasion on which officials of the Wales Gas Board and their wives have attended a function together since the Board's establishment last year. Front Row, left to right: Mr. T. Mervyn Jones (Chairman), Mrs. T. Mervyn Jones, Mr. F. Boardman (Chairman and Convener, Cardiff Group, President of the Club), Mrs. T. A. Morgan, Mrs. F. Boardman, and Mr. E. M. Edwards (Member). Mr. R. S. Snelling, Deputy Chairman of the Board, is also seen in the centre of the group.

A Building Exhibition will be held jointly by the Shrewsbury Technical College and the Ministry of Works in the Technical College, Abbey Foregate, Shrewsbury, from March 24 to 31. The objects of the exhibition are to bring to the members of the Building and Allied Industries the results of recent research and development, and to present to the general public, and to parents in particular, the opportunities afforded by the building industry for choosing careers. The Ministry's displays will include a demonstration of thermal insulation, illustrating the reduction in heat losses obtainable by a better use of traditional and new materials.

LONG SERVICE PRESENTATIONS



The above photograph was taken at a meeting of the Northern Gas Board in Newcastle on February 15 when presentations were made to seven employees of the Board with 50 or more years of service. It shows, left to right, standing: Mr. H. A. Sisson, Alderman J. Hoy, Lieut-Col. H. H. Peile, and Alderman C. R. Flynn (members of the Board); Mr. E. Crowther (Chairman); Mr. J. R. Bradshaw (Deputy Chairman); and Mr. J. F. Jackson (Secretary). Seated are the recipients—Messrs. J. Angus (Newcastle), W. Ashton (Hartlepool), J. H. Greathead (Sunderland), A. E. Lockey (Bishop Auckland), H. H. Musgrave (Hartlepool), P. H. Pearson (Durham), and A. L. Robertson (Wigton). The Chairman (Mr. E. Crowther), in presenting to each employee a certificate and cheque, referred to the long and meritorious service which they had given to the industry and the capable and devoted manner in which they had performed their duties. The Chairman also expressed the hope that in their retirement they would be granted good health and happiness for many years.

Tottenham Gasworkers' Dispute

ARISING from the reference to arbitration of the recent dispute at the Tottenham (Willoughby Lane) Gasworks, made by the Gas Engineers' National Guild to the Ministry of Labour and National Service (referred to in the *Journal* of February 22, p. 453), a meeting to consider the situation was held at the Ministry on March 7, of the representatives of the Eastern Gas Board, the Guild and the organisations representing the employees, when it was agreed that the following statement should be issued to the Press by the Ministry :

'At a meeting on March 7, at the Ministry of Labour and National Service, under the Chairmanship of the Chief Industrial Commissioner, Sir Robert Gould, between representatives of the Eastern Gas Board and of the unions and organisations representing the men and staffs employed at Willoughby Lane gasworks, the present situation there arising out of recent difficulties was discussed. The gas board announced that, as a result of their enquiries, Mr. C. A. Deas retained their full confidence and was completely cleared of any responsibility for the recent dispute.

'The meeting agreed that the consultative machinery operating at the gasworks should be re-examined, with a view to more complete liaison both in the interests of management and in the interests of harmonious relations for future working. The gas board also stated that they would give further consideration to the arrangements at Willoughby Lane and the operational activities there.'

The Gas Engineers' National Guild was represented at the meeting by its Executive Chairman, Mr. J. R. W. Alexander. The further consideration to be given by the gas board to the arrangements at Willoughby Lane includes the continued suspension of Mr. C. A. Deas from duty as Works Engineer since January 12.

A Protest against the proposal of the East Midlands Gas Board to increase the price of gas for street lighting from 2s. 1d. per 1,000 cu.ft. to 3s. 1.4775d. was made by Alderman J. W. Rayment at a recent meeting of the Lincoln City Council. He said that 2s. 1d. per 1,000 cu.ft. might have been a low price, but that did not excuse so high an increase ; he thought they should take the matter up with the Gas Board as an aggrieved customer.

The Government of the Republic of Ireland has empowered Limerick Corporation to borrow up to £500,000 to extend the limits of the gas undertaking in Limerick to the present borough, together with other parts of the Public Health districts of Counties Limerick and Clare, not more than one mile from the city boundary. A new plant, costing £75,750, will be installed and will provide an increase from 400,000 to 1 mill. cu.ft. per day in output. A new gasholder, with a capacity of 1,200,000 cu.ft., will be erected at a cost of £70,000.

Theatre Gas Lighting

The need to ensure public safety has led to very stringent regulations regarding the lighting of large public halls and places of entertainment. It is a statutory requirement that there should be a secondary lighting system, to ensure safety in the event of a failure of the main supply, and many theatres, cinemas, restaurants, schools, &c., make use of gas for this purpose.

The photograph below illustrates an installation carried out in December at the King's Theatre, Hammersmith, by William Edgar and Son, Ltd., of Hammersmith, W.6, all the equipment being of their own manufacture. The wall fittings are the B.W.39 type, specially designed for secondary lighting, but also adaptable for domestic use. The burner is a single inverted Bijou, with permanent by-pass, and gas and air regulators, and is so constructed that it cannot be tampered with by the public. The exit boxes are also gas-lit. Both the wall fittings and the exit boxes are lit before the public is admitted, and kept alight throughout the performance. In addition to the auditorium, the lobbies and passages in all parts of the house

A view of one of the exits with gas-lit exit box above; and, in the top right-hand corner, one of the gas-lit wall fittings.

are equipped with secondary lighting, over 50 separate fittings being installed.

Secondary systems of this type have the approval and recommendations of the London County Council, the Middlesex County Council, and other public authorities. Other public halls which have recently been equipped by this firm include the Cricklewood Dance Hall, the Rivoli Cinema, Ruislip, the Hendon Hall Hotel, the London Palladium, and the Café Anglais Restaurant.

Megator Pumps and Compressors, Ltd., have moved their offices and showrooms from Feltham, Middlesex, to 43, Berkeley Square, London, W.1.

Gas at the Ideal Home Exhibition

An Examination of the Industry's Contribution

IF there is one predominant fact about the *Daily Mail* Ideal Home Exhibition, it is that every year it becomes larger, more popular, and more spectacular. For this reason a review of the exhibition becomes increasingly difficult to prepare. It is, surely, the last word in efficient organisation and universal appeal. Year by year its public returns, hungry for new sensations, new gadgets, new hopes; year by year its public departs, satiated, exhausted, and heavily laden. At every exhibition the promotors produce some new, fantastic creation to raise the visitors' eyebrows. They need not trouble, for the people would come just the same. Some experience of this show leads one to believe that the real attraction is the acquisition of bargains—the carrier bags stuffed with custard powder and jam at half shop price. Nevertheless, there are those who only come to look, those who come with the preconceived intention of examining every make and type of one particular article, and those whose minds are willing to be diverted to the purchase of almost anything, whether they need it or not.

This year the attractions are as potent as ever. Mrs. Brown, descending from the special tube train at the Olympia station, is greeted by a fanfare of trumpets and Richard Dimbleby's honeyed welcome. Entering the Grand Hall she is confronted by a 'silverweb citadel' of aluminium with pavilions, avenues, and a 75 ft. arch. Altogether this structure covers nearly 20,000 sq. ft. and is an undeniably impressive sight. Recovering from this, Mrs. B. has the choice of 'moonlight' in the gardens, a West African village, or the complete story of sugar, by courtesy of Messrs. Tate and Lyle, Ltd. With wonders such as these making claims upon her attention, it may be some while before she succumbs to the lure of the Village of Ideal Homes, which constitutes perhaps the most constant attraction of the exhibition each year. And, indeed, this is an exhibit of interest to builder and layman alike—not forgetting the gas industry representative. For gas is remarkably well represented in the five houses which grace the National Hall.

Five Ideal Houses

Perhaps the greatest interest centres round a single-storey New Zealand house, constructed of timber, and of a type which would cost its tenant about 30s. a week. This has an electric range (as have the majority of New Zealand homes), and a solid fuel clothes boiler. The other houses—three traditional ones of brick and one of manufactured stone—can be built for private owners who are able to obtain a building licence, and vary in cost from about £1,200 for a 'semi' which is intended to be built in quantity on estates, to £2,166 for a frost-proof cottage-bungalow with four bedrooms and two bathrooms.

The latter is the Berg house, built by E. & L. Berg, Ltd., and boasts high insulation of walls. This is accomplished by the new 'Milcel' block, which is used to form the inner lining, and the external 2 in. brick cavity walls. Another interesting feature is the plumbing unit between kitchen and bathroom, including rising main and all wastes, which is completely encased in Fibreglass wool, thus eliminating freezing. The house is equipped with a Cannon K.150 (all white) cooker, an Ascot water heater, an L.300 Electrolux refrigerator, a Ranalagh drying cabinet, a white Dean washing machine, and a Bratt Colbran one-unit Portette portable fire.

The next house, built by C. H. Coates, Ltd., is a country-type home with the dining room situated adjacent to the excellent kitchen, which contains an M.151 Electrolux refrigerator built into the larder, a Trianco self-feeding boiler, a cream Radiation 1640 cooker, a Hurro washing machine, and a Ranalagh drying cabinet. Other gas appliances in the house include a Radiation 7305 inset fire, a Bratt Colbran two-unit Lutello fire, an FA-Neat convector fire, an FA-Neat portable fire, a Radiant Heating Minitherm towel rail, and an Ascot 32/6 water heater.

Davis Estates, Ltd., contribute a house which has, among other notable features, a Neo-fire (Ideal) all fuel grate incorporated in the dining room, which feeds radiators in the dining room and two bedrooms, and supplies hot water. Incidentally, this house has a coal bunker, filled outside, which supplies fuel direct to the kitchen through a stainless steel hatch. It is extremely well equipped with gas appliances, including an Ascot 32/6 water heater, an Electrolux L.300 refrigerator, a Cannon R.7 radiator, a Main 'Newscreen' portable fire, a Bratt Colbran 'Portette' portable fire, and a Ranalagh drying cabinet.

The fifth and last house is the Unity house, sponsored by Unity Structures, Ltd., and furnished by the Council of Industrial Design. This is really a 'prefab,' but looks much like a traditional house; it has the advantage of rapid construction in all weathers. It is, moreover, claimed to be more sound-proof and to have greater resistance to cold and heat than ordinary houses. Gas appliances fitted include a General Gas Appliances C.31/4 cooker, an Ascot 503 streamlined sink heater, and an Electrolux M.151 refrigerator.

The Gas Pavilion

The nationalised fuel industries are still competing energetically for the favour of domestic consumer, and this competition, itself an extremely healthy sign, is much in evidence at the Ideal Home Exhibition. Electricity and gas are opponents of long standing at this show, and, as is well known, the preparations of each side proceed under an impenetrable cloak of secrecy almost up to opening day. The tussle of these giants is good entertainment, and while our sympathies naturally lie with the gas exhibit, it is necessary to study the work of both parties, giving credit where it is due, and thereby learning whatever lessons the contest contains. Elsewhere in this issue, the 1950 gas pavilion is criticised with some severity, but it is criticism given in good part and must not be taken as a repudiation of the hard work and skilful ideas which have gone into the designing of Gas Council's exhibit. By any standard, this is a fine piece of work and its designers deserve every credit; but it must be judged on the same plane of quality as that employed by the exhibit of the British Electrical Development Association. Last year the *Journal* believed that the gas pavilion was an improvement on its competitor; this year it is not so sure. But is this due to an improvement in the electricity stand, or a deterioration in the gas exhibit?

Tableaux and Appliances

Probably it is due to both, but largely to the former. E.D.A. has achieved a remarkable improvement in its exhibit and has, perhaps wisely, made no attempt to put over a story or convey a theme. On the other hand, the Gas Council has attempted to repeat its 'Alice in Thermland' success of last year with another adaptation of a Disney film. 'Treasure Island' has, however, a closer grip of realism, a fact in many ways detrimental to a display of this nature, in which pure fantasy is an easier goal. Briefly, the exhibit is divided into two main sections, one of which is devoted to the 'Treasure Island' tableaux and the other to a large display of gas and coke-burning appliances. The six scenes of the tableaux show characters in the Robert Louis Stevenson story performing various tasks which gas could simplify, and in each scene a 'vision' of the appropriate appliance lights up. The figures are cleverly modelled, but are *too lifelike* and savour too much of the waxworks. With the rest of the stand there can be no quarrel, for although our competitors have displayed their equipment more attractively, the gas appliances can be more readily handled by the public—and that is the important thing. The list of appliances is too long to reproduce in these columns, but some idea of the size of this display may be gained from the fact that 13 water heaters, 2 gas-fired boilers, 15 cookers, 7 coke fires, 2 refrigerators, 7 radiators, 7 washing machines and wash boilers, 1 drying cabinet, 1 shower cabinet, and 4 fires, 6 portable fires, 5 boiling rings, 6 hotplates, 3 coke boilers, and 2 freestanding coke stoves are exhibited. This does not include the appliances employed in the tableaux, which number an additional 19. Thus it will be seen that a very representative range of gas appliances is displayed, and in view of the absence of most manufacturers of gas appliances from the list of exhibitors, the Gas Council stand performs a valuable function in showing the public the maximum amount of equipment.

Minor features of the stand are a demonstration cooker, which is fitted with automatic revolving shelves to demonstrate with model joints and puddings, &c., how the thermostatic control produces perfect cooking, and the ever-popular 'magic' teapot, illustrating the operation of a boiling water heater.

To those who may even now question the need for the two industries to have stands of this size, the words of Col. H. C. Smith, C.B.E., D.L., J.P., Deputy Chairman of the Gas Council, might be quoted. Speaking at a pre-view of the Council's exhibit, he said: 'There is every need for competition, a fact which has been recognised by the Minister of Fuel and Power. It is of the utmost importance that the public should retain this freedom of choice and that each family should be allowed to install the fuel it prefers. Moreover, competition is healthy; it keeps us on our toes, constantly striving to improve our products and to find new uses for our fuel. To give you an instance of what I mean: There are, I believe, over 5,000,000 homes in this country still without baths. Who is going to supply the hot water these homes will need and how can those families make up their minds which fuel will serve them best if they are not kept fully informed of the appliances and services of each fuel?'

Cookery Demonstrations

The gas industry also receives valuable publicity on the Ministry of Food exhibit (Stand No. 310), where the Gas Council have been invited by the Ministry to take part in a series of cookery demonstrations. Twenty-three Home Service Advisers from the North Thames Gas Board and the South Eastern Gas Board prepare a number of appetising and economical dishes on the latest gas cookers. Demonstrations are continuous from 11 a.m. to 9 p.m., and may be seen on the following future dates: March 9, 14, 18, 23, and 27. Other Ministries present at the exhibition include the Ministry of Agriculture and Fisheries, and the Ministry of Town and Country Planning. The Coal Utilisation Joint Council is also represented (Stand No. 69) and displays working demonstrations of continuous burning appliances suitable for all types of solid fuel. These include open fires, convector open fires, free-standing and inset openable stoves, insulated cooker and water heaters, combination grates and independent boilers.

Among the trade exhibitors, the following are of particular interest to the gas industry:

Stand No. 64.—**Ascot Gas Water Heaters, Ltd.,** have a pleasant stand of rather more conventional design than usual, which embraces a wide range of equipment. Particular mention might be made of the two models here introduced to the general public for the first time—the new Type 503 instantaneous sink heater, and a built-in multipoint heater incorporating the balanced flue principle. FA-Neat and Radiant Heating appliances are also featured, together with Compoflex tubing.

Stand No. 56.—An attractive selection of domestic gas equipment is featured at the **Thomas De La Rue & Co., Ltd. (Potterton Gas Division)** stand, where the principal attraction is the new De La Rue large capacity cooker, the **B.6,** with six burners incorporating their own simmering device, and the **G.5,** with five burners and a grill; the latter shows for the first time the new model with fitted plate rack. Multipoint and boiling water heaters are also shown, together with Potterton boilers in three sizes. The De La Rue material, 'Formica,' and the new plastic floor tile are also utilised in the stand design.

Stand 68.—The well-known range of 'Portcullis' gas fires are displayed to good advantage on the **Bratt Colbran, Ltd.,** stand, together with other examples of the firm's products. The setting of these fires in handsome fireplaces gives an impression of realism and comfort. Also shown is the coke-burning, gas-ignited 'Chevin' convector.

Stand No. 57.—Hot water boilers, both central heating and domestic, constitute the principal attraction of the stand of **Crane, Ltd.**; a handsome range of domestic hot water supply boilers in enamelled finish are also a prominent part of the exhibit.

Stand No. 249.—**Easiwork, Ltd.,** display a fitted kitchen illustrating how an existing kitchen may be made labour-saving and efficient at a moderate cost. A most attractive range of kitchen cabinets, sink units, &c., is displayed. A Main 177/R.A. cooker and four Ascot R.12 water heaters are included.

Stand No. 271 contains a range of products manufactured by **Electrolux, Ltd.** These include the well-known silent refrigerators, which may be operated by gas, electricity, or oil.

Other firms well known to the gas industry which are represented at the Ideal Home Exhibition are: The British Vacuum Cleaner & Engineering Co., Ltd., Dunlop Rubber Co., Ltd., Hoover, Ltd., Jenolite, Ltd., the Kleenoff Company, National Cash Register Co., Ltd., Permutit Co., Ltd., Philplug Products, Ltd., Rotary Hoes, Ltd., and Rozalex, Ltd.

Miscellaneous Exhibits

There is, moreover, a considerable number of gas appliances utilised on various other stands, the following giving a rough guide to their whereabouts: Huwood, Ltd. (a Main 'Pronto' water heater), Millard Bros., Ltd. (an Ewart M.60 water heater), Procea, Ltd. (Ewart M.60 and M.210 water heaters), Citrus Products, Ltd. (two Ewart M.60 water heaters), United Canners, Ltd. (an Ascot R.52/1 water heater and a G.L.C.I. cooker), Bendix Appliances, Ltd. (Potterton storage water heater), Vitbe, Ltd. (an Ascot baker's model water heater), Chas. Southwell, Ltd. (an Ascot R.12 water heater), Hoover, Ltd. (a 32/6 Ascot multipoint water heater, a M.210 Ewart water heater, a De La Rue 175 water heater and an Ascot 503 sink water heater), Foster Clark, Ltd. (a Ewart M.60 water heater), Hovis, Ltd. (an Ascot baker's model multipoint water heater and an R.12 water heater, and a Ewart M.60 water heater), Maconachie Bros. (an Ascot 32/6 water heater and two G.L.C.I. cookers), Tate & Lyle, Ltd. (two Ascot R.12 water heaters), J. S. Pritchards, Ltd. (various gas appliances), Interoven, Ltd. (own solid fuel appliances), Oxo, Ltd. (an Ascot R.12 water heater), British Kitchencraft Co., Ltd. (two Ascot R.S. 52/1 water heaters and 12 gas rings), Nestles, Ltd. (two Ascot R.S.52/1 water heaters), Advance Laundries, Ltd. (a Controlled Flame 8S. steam boiler, Marshalls Food Products, Ltd. (Parkinson Mark IV 'Renown' cooker, Ewart M.60 water heater, L.300 refrigerator), Bristow, Ltd. (a Ewart M.210 water heater) Thor Appliances, Ltd. (five Ascot 32/6 Multipoint water heaters), Lever Bros. (an Ascot R.12 water heater), Cadbury Bros. (two R.S.52/1 water heaters), Cantrell & Cochrane, Ltd. (a Main 'Pronto' water heater), Heinz, Ltd. (an Ewart M.60 water heater), Max Factor, Ltd. (a De La Rue 175 Multipoint water heater), Nicholas Waye Bros. (a Ewart M.60 water heater), Danish Agricultural Producers (an Ascot R.12 water heater), Evanol, Ltd. (an Ewart M.60 water heater), Robinson Barley (an Ascot R.12 water heater), Marber & Company (an Ascot R.12 water heater), Nevastaine (an L.300 refrigerator and an Ewart M.60 water heater), British Iron and Steel Federation (a Controlled Flame 4S. steam boiler, a G.L.C.I. cooker, an Ascot R.S.52/1 water heater, and an L.300 refrigerator).

British Tar Confederation

At the annual general meeting of the British Tar Confederation and at meetings of the Executive Board held subsequently the following were elected officers of the Confederation for 1950: *President:* Colonel H. C. Smith, C.B.E., D.L., J.P. *Honorary Treasurer:* C. E. Carey. *Chairman of the Executive Board:* W. K. Hutchison. *Vice-Chairmen of the Executive Board:* Sir Walter Benton Jones, BART., and Major A. G. Saunders.

The Executive Board consists of ten representatives nominated by each of the Association of Tar Distillers, the British Association of Coke Oven Tar Producers, and the Gas Council, and they are as follows:—

Association of Tar Distillers: L. W. Blundell, C. E. Carey, E. Hardman, Capt. C. W. Harriss, C. Lord, Wm. McFarlane, S. Robinson, Major A. G. Saunders, L. Shuttleworth, W. A. Walmsley.

British Association of Coke Oven Tar Producers: A. Bradbury, G. W. J. Bradley, W. Robson Brown, M.P., K. McK. Cameron, F. W. O. Doddrell, C. F. Dutton, G. A. Hebden, Sir Walter Benton Jones, BART., Leslie O'Connor, C. F. Sullivan.

Gas Council: S. Black, F. Boardman, D. D. Burns, Colonel W. M. Carr, O.B.E., T.D., J. H. Dyde, W. K. Hutchison, Alex, W. Lee, A. McDonald, M. Milne-Watson, S. E. Whitehead, O.B.E., J.P.

Three Grey Editions have been published by the Institution of Gas Engineers. These are 'Electro-Detarring,' by K. W. Francombe (Whessoe, Ltd.), publication No. 358/165, 'Peak Load Problems in the United States,' by R. W. Hendee (President, American Gas Association), publication No. 350/160, and 'A Survey of the Liquor Disposal Problem,' by E. H. M. Badger (North Thames Gas Board), publication No. 360/167. Copies can be obtained from the Institution, 1, Grosvenor Place, S.W.1, price 2s. 6d. each, post free.

Southern Gas Board's Helpful Co-operation

Southampton Affords Romsey a Bulk Supply

THE third meeting of the Southern Gas Consultative Council was held at the Grand Hotel, Bournemouth, on March 1 under the chairmanship of Alderman J. W. Moore, who reported the replies of the Southern Gas Board to a number of points raised by the divisional committees.

At a meeting of the Western Divisional Committee held at Bournemouth a member had raised the question of transporting coal by canals, not merely from the point of view of the Southern area but on grounds of national economy. The Chairman stated that the Chairman of the area board had replied that the whole question of the transport of coal had received the earnest consideration of the board and the divisional general managers and every avenue possible was being explored to reduce the cost of transport. The possible use of canals had not been overlooked, but in the Southern area they were of comparatively little value from the point of view of the gas undertakings. Most of the larger undertakings were on the south coast and received all their coal supplies by sea, for which the board had special rates. Although the subsidy on coastwise shipping had been withdrawn it was still cheaper to get the coal by sea than by any other means.

By way of illustration the Chairman mentioned the case of Andover, whose gas coal was conveyed from Southampton by the board's own lorries, the actual cost still being below that for rail-borne supplies. The board had been informed that the matter was being looked at from a national angle, and that where there was any advantage to be gained the canals would be used for the purpose indicated.

No Hospital 'Group' Terms

Alderman **S. J. Gale** (Bridport) enquired whether the area board was prepared to regard the West Dorset Group of Hospitals as one unit for the purpose of fixing special rates for gas supplied.

The **Chairman** replied that the board could not agree to that suggestion. The Bournemouth Group of Hospitals was not treated as a single unit. Similarly it would obviously be unfair to say that because an individual had a dozen shops in Bournemouth he should be granted special rates as one large consumer.

Arising out of a report from the Northern and Central Divisional Committee, which had met at Reading, a question was raised as to the alleged unsightly effect of constructing a gas main alongside a river bridge at Yately. The **Chairman** explained that the gas undertaking's original idea was to construct the main underneath the bridge where it would not have been seen, but the local authority insisted that the main must be carried on concrete piers 12 to 15 ft. away from the bridge, and the area board had no option but to comply with the council's wishes.

The Northern and Central Divisional Committee also reported on the question of by-meters. Attention had been called to the fact that owners of premises were supplying gas to occupiers of flats at a much higher charge than that fixed by the area board, by means of individual by-meters set at a higher rate. The matter had been taken to the area board and through it to the Gas Council, and the view had been expressed that the margin of profit should be regulated; a maximum of 7½% had been suggested as reasonable.

Meter Rentals

The question of meter rentals was again mentioned and the view was expressed that because the butcher or the milkman did not charge for the instruments employed in measuring meat or milk the area board should discontinue meter rentals.

The **Chairman** assured the consultative council that not only the area board but the industry as a whole had considered the matter on many occasions. Although the private trader did not charge so obviously for the measuring instruments he employed he recovered their cost in some more indirect way. If the area board discontinued meter rentals it would have to make up the loss by increasing the price of gas, and it was deemed better, at any rate for the present, to adhere to the meter rental system.

Regarding spare parts for gas appliances, the **Chairman** stated that instructions had been given to the manager of every undertaking that if he was unable to supply any necessary spare part for a gas appliance he was to endeavour to obtain it from a neighbouring undertaking within the area, and failing that, to go outside the area to get what was needed. Only as a last resort would the area board undertake the manufacture of spare parts; even then the board would be restricted in its activities by the observance of patent rights.

Arising out of the report of the Eastern Divisional Committee, which had met at Portsmouth, the **Chairman** announced that the gasworks at Romsey was to discontinue the manufacture of gas, and bulk supplies would be obtained from Southampton.

Revised System of Charge

Formal notification was received from the area board that supplies from Southampton would start on April 1. Hitherto gas consumers at Romsey had been charged on a volumetric basis but under the new arrangement a calorific value of 460 B.Th.U. was declared and the price of gas would in future be 1s. 5.6d. per therm, which would compare reasonably with the present charge. The new price would be the same as that in other parts of the Southampton outer area, and Romsey consumers would receive a better supply of gas with a higher thermal content.

Councillor Mrs. **Oliver,** Deputy Chairman, expressed surprise that after announcing its determination to simplify the work of its accounting department as much as possible by the elimination of decimal points the board had decided to charge 1s. 5.6d. per therm at Romsey.

The **Chairman** replied that 1s. 5d. would have been too little and 1s. 6d. too much. The general aim of the board would still be to do away with decimal fractions whenever practicable.

Formal notice was given of the intention to change the calorific value of gas supplied at Bournemouth from 460 to 475 B.Th.U., and at Swanage from 450 to 475 B.Th.U.

Councillor **J. T. Davies** (Gillingham, Dorset) told the consultative council that there had been difficulty for years between the former Shaftesbury, Gillingham and District Gas Company and the local authority with regard to the discharge of gasworks liquor into the sewers. Since nationalisation, however, a new spirit of co-operation had been evinced between the area board and the local authority, and their differences were well on the way towards amicable settlement.

The **Chairman** welcomed this testimony to the area board's activities and said his own impression after several months' membership of the board was that the whole organisation was trying to be co-operative and to do its best in the interests of the gas consumer.

Salesmen Visit Falkirk

The Scottish Eastern Salesmen's Circle paid a visit to the works of R. & A. Main, Ltd., Falkirk, on February 8. Fifty-six members attended, the majority travelling by two private buses from Edinburgh. After assembling in the canteen the party of 56 divided into small groups each with its own guide for a comprehensive tour of the works which, while conducted in a friendly manner, had the precision and timing of a military operation as there was no overlapping of the parties and all arrived back at the starting point simultaneously. The tour showed the stages from design and research to the pattern making craftsmen and thence to the mass production machines, ovens, and furnaces producing cooking and space heating appliances, giving an overall picture of vast teamwork.

The party was entertained to tea and a vote of thanks was moved by Mr. T. Smith, Edinburgh, President of the Circle, who said that the educational value of such visits could not be overstressed. Mr. Dyson, Works Manager, R. & A. Main Ltd., deputising for Mr. Wortley, Managing Director, who was indisposed, said in reply that he welcomed such visits as being of mutual value to manufacturers and salesmen. He described some of the administrative difficulties characteristic of the times and pointed out that the manufacturers were making great efforts to meet demand, and where this was not being met the causes were invariably beyond their control.

Integration Has Brought a Better Service

Report to North Thames Gas Consultative Council

THE North Thames Gas Consultative Council at its monthly meeting at St. Ermin's Hotel, Westminster, on March 2 was informed that as a result of the integration of undertakings that vested in the North Thames Gas Board it had been possible at times of high demand for gas to adopt a policy of controlled transfer of gas in substantial quantities from districts where there had been a margin of capacity to others where the demand had outstripped supply. An example of this benefit to the consumer was given by the **Chairman** (Councillor E. Bayliss) in presenting this report from the board. On January 27, 28, and 29, which came during the recent cold spells, the gas sent out from the Gas Light District to other districts amounted to over 5½ mill. cu.ft. Of this quantity 1½ mill. cu.ft. were sent to Romford District where, as the council would remember, the calorific value of the gas supplied was recently made the same as that in the adjoining Gas Light District; this was the first time that gas had thus been sent to the Romford District, and the transfer was made through connecting mains laid since vesting date.

The Chairman then reported three replies from the board to matters raised with them by the council after the last monthly meeting. Having been previously informed by the board that it was not possible to supply statistics relating to the number of consumers and the amount of gas consumed by domestic, industrial, and commercial users in each of areas of the council's district committees, the council had asked for an estimate of the proportion of gas used by the different categories of consumer.

The board replied that to provide the information would involve a detailed analysis of the records of the board's 1,800,000 consumers, which it was felt would not at that time be justified. It was possible, however, to give gas consumptions (though not numbers of consumers) under the headings of domestic, non-domestic, and public street lighting, for the areas of the district committees. The board would give further consideration to the council's request in the future process of unifying statistical information for the areas as a whole.

Gas Showrooms

A request from Willesden and Harlesden for the gas showrooms to remain open on Saturday afternoons, when shopping was at its height, had been passed on to the board. The board's reply was that it was reviewing business done in the showrooms and that it contemplated opening on Saturday afternoons a small number of showrooms in suitable places for a trial period. These would now include those in the High Street, Harlesden, and in Kilburn High Road, which served the Willesden and Harlesden area. Since, however, representatives of the staff had been asking that certain showrooms now open on Saturdays should be closed then, it was intended first to discuss with them the proposed Saturday afternoon opening.

In answer to a question whether the board intended to process themselves the by-products obtained from all gasworks recently vested in the board, it was pointed out that although most by-products were already being processed in that way at Beckton and Southall, and an increasing proportion would be processed there in the next few years, it had to be remembered that the provision of necessary plant involved heavy capital liabilities, whereas the by-products market was by no means stable and would be the scene of increasing competition.

Areas of Gas Supply

The Chairman reported that at the recent meeting of the Berkshire and Buckinghamshire district committee of the council the Easthampstead Rural District Council had raised the possibility of altering the areas of gas supply to conform with the areas of the local authorities; the Easthampstead district was divided between the North Thames and the South Eastern Gas Boards. The **Secretary** (Mr. W. Elliott) said that he had written to Councillor W. A. Preece, representative of the Easthampstead council on the district committee, to the effect that this was not an isolated instance; there were no less than 17 local authorities similarly placed in the North Thames area. The situation arose from the relevant Acts of Parliament, and any alteration would involve both legal formalities and a considerable expenditure of money in transferring the mains and equipment in those areas which would be affected.

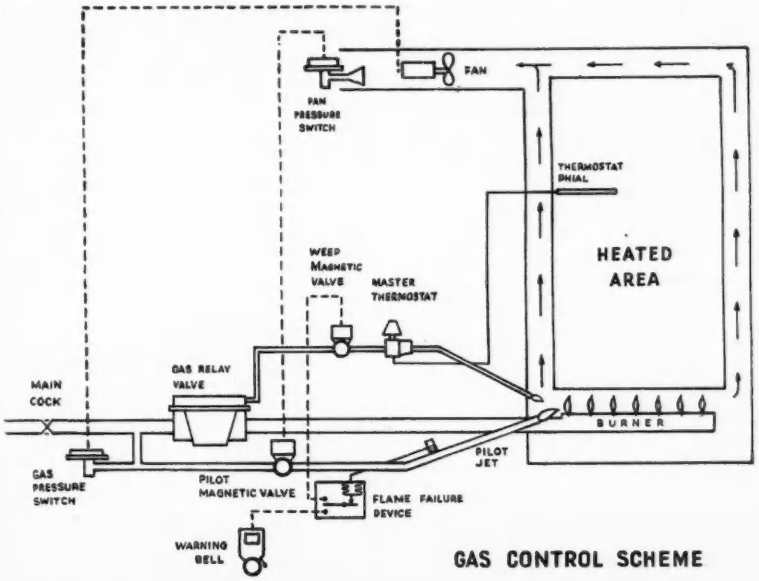
The Chairman informed the council that steps had been taken to improve the gas pressure at Chalfont St. Peters and at Cookham, where pressure was low on Sundays.

A report from the Ministry of Fuel and Power on gas tests in the North Thames area during the December quarter was considered and accepted. the council being informed that as from April 1 the calorific value of gas in the Ascot district would be increased to conform with the other districts. In conclusion the Chairman announced that the next meeting of the council would be held on March 30 at Watson House, when members would have the opportunity of seeing some of the research work there.

Our photograph shows members of the Midland Junior Gas Association at the Association's dinner and social evening held at the Imperial Hotel, Birmingham, on February 11. The President (Mr. S. C. Bentley), who was in the chair, gave a cordial welcome to those supporting the function, making particular reference to the presence of a number of past Presidents. He was immediately supported by the senior and junior Vice-Presidents, Mr. J. Palser (Birmingham) and Mr. R. B. Watkins (Coventry), by Mr. A. W. Attwood (Coventry) the Treasurer, and by Mr. H. J. Reynolds (Wolverhampton), the Hon. Secretary. The 10 past Presidents who attended were: Mr. W. J. Pickering (Birmingham) 1920-21; Mr. J. H. Gee (Birmingham) 1925-26; Mr. H. R. Hems (Birmingham) 1927-28; Mr. W. Macnaughton (Wolverhampton) 1930-31; Mr. F. A. Jenkins (Leamington) 1936-37; Mr. E. T. Pickering (Birmingham) 1937-38; Mr. A. W. Attwood (Coventry) 1938-41; Mr. A. Hill (Birmingham) 1946-47; Mr. S. Brockbank (Walsall) 1947-48; and Mr. C. L. Evans (Birmingham) 1948-49. Acknowledgments were made of the arrangements carried out by Mr. H. J. Reynolds, who acted as compére for the entertainment which followed the dinner. A vote of appreciation was also passed to the artistes on the proposition of Mr. W. J. Pickering, to which the hon. Secretary responded on their behalf.

A Gas Control Scheme

OUR diagram is of a gas control scheme for large drying ovens, box ovens, conveyor driers, and similar gas-fired plant in which on-off thermostatic control only is desired. It has been designed by the British Thermostat Co., Ltd., Sunbury, Middlesex, to provide against the possible adverse consequences of incorrect lighting-up, pilot flame failing, mains gas supply failing, electricity supply or fan failing, fall in gas pressure, and defect in the control system.



GAS CONTROL SCHEME

In the event of incorrect lighting-up procedure, gas cannot reach the pilot burner, the weep outlet or main burners unless, in the first instance, the fan is running. Apart from manual switching, the fan only runs if it has been set into operation by gas pressure (at the gas pressure switch)—that is, after the main cock has been opened; gas reaches the main burners only after the pilot has been lit.

In the event of pilot light failure, this causes the main circuit of the flame failure device to break, with the result that the magnetic valve in the weep closes and causes the relay valve to shut off the mains gas. A second circuit is closed by the flame failure device, and this operate a warning bell or light, &c. The pilot gas flow continues unless the fan is switched off. Gas cannot reach the main burners until the correct lighting-up procedure is repeated.

In the event of mains gas supply failure, the pilot light will naturally be extinguished with the result that the magnetic valve in the weep and the relay valve closes. The fall in pressure at the gas pressure switch stops the fan, which in turn breaks the circuit in the fan pressure switch and closes the pilot magnetic valve. Gas cannot reach the main burners until the correct lighting-up procedure is repeated.

In the event of electricity supply or fan failure, the two magnetic valves utilised close automatically when not energised, shutting off the gas supply to the pilot burner, the weep line and the main burners. On fan failure the fan pressure switch breaks circuit, closes the pilot magnetic valve, and thus cuts off the supply to the pilot and thereby the main burners. The extinction of the pilot flame also causes the magnetic valve in the weep to close and shut off the weep flow. Gas cannot reach the main burners until the correct lighting-up procedure is repeated.

In the event of a fall in gas pressure, the gas pressure switch breaks circuit, with the result that the fan stops and the entire gas supply is cut off. Gas cannot reach the main burners until the correct lighting-up procedure is repeated.

In the event of a defect in the control system, the control system shuts down and remains inoperative until such time as the cause of failure is remedied.

The February number of the 'Powers-Samas Magazine,' published by **Powers-Samas Accounting Machines (Sales) Ltd.**, Powers-Samas House, Holborn Bars, London, E.C.1, has as its main feature an interesting article on the billing of accounts and maintenance of debtors' records by punched cards as practised by the Glasgow Sub-Area of the South West Scotland Electricity Board.

A new recipe book just published by **Radiation Ltd.** is available from gas showrooms at 6d. per copy or direct from Radiation Public Relations Department at 7, Stratford Place, London, W.1. This booklet, called 'Entertaining Today —the New World Way,' has been prepared to interest the hostess and, indeed, the host, not forgetting the young people, in some of the foods, especially the processed foods, which are now returning to the shops. All recipes included have been tested and proved in the Radiation research kitchens.

The window display of Hurseal, Ltd., Regent Street, London, won the third prize in the window dressing competition organised by the Regent Street Association in conjunction with the Council of Industrial Design. The display was designed and carried out by students of the City of Canterbury College of Art, and showed metal figures representing gas, electricity, and paraffin, each used in Hurseal radiators. The very effective predominating colours were yellow and shades of red, suggesting warmth. Students of the College study every kind of art, with particular reference to becoming first class industrial designers. They learn a wide variety of subjects from book production and printing to metal working and furniture. The metal figures shown in the window were made by the students themselves.

The Gas Industry in France

AN ADDRESS BY M. A. BARIL

[Abstract Translation by Our Own Correspondent]

ON January 6, M. A. Baril was installed President of the Société des Ingènieurs Civils de France. M. Baril is well known in England as a Past President of the Association Technique de l'Industrie du Gaz en France and of the International Gas Union of which he was one of the founders. Introducing him to the members his predecessor, M. L. Cambournac, said: 'Like many of his colleagues, M. Baril began his working career as a workman. He quickly won his spurs: foreman, draughtsman, chief erector, engineer, passing through all these grades in different works and thus completing his training. He had long been marked by M. Réné Masse, who attached him to himself as collaborator first for researches into the iron deposits of Calvados, then in the Sté. des Freins Lipkowski, and finally in the Sté. d'Eclairage, Chauffage et Force Motrice which M. Baril entered in 1911 as engineer-in-chief and where he occupied successively the posts of assistant technical director, technical director, and finally in 1926, joint managing director, the position he occupied until the end of December, 1940, when he reached the retiring age. He had to work in the last months of 1940 under the rod of the occupation authorities in particularly delicate conditions which he succeeded in doing in the most dignified manner.' M. Baril's services to the gas industry were rewarded by his appointment in 1934 as Officier de la Lègion d'Honneur.

After returning the compliments of his predecessor and paying homage to his former chief M. Réné Masse, M. Baril delivered an address on the subject of the importance of the gas industry in the world and in France. He began with a summary of statistics of the industry in Europe and in the United States of America—ground covered for the most part by papers presented to the International Gas Union last year.

The second part of his address was devoted to a consideration of the fixing of the calorific value of town gas in France, 'a subject which at first sight may seem to have a limited range but which had had and may have marked consequences upon our commercial balance.' It was not until 1915, when to meet the emergencies of war debenzolisation became obligatory, that for the first time the standards of illuminating and calorific powers were relaxed. At the armistice they came again into force and it was not until April, 1921, that it was decreed that the quality of town gas should be defined by its calorific value in calories (gross) per cubic metre, dry at the temperature of 0°C. and pressure of 760 mm. This decree also enacted that: 'To avoid, in the general interest, all loss of calories without advantage to the consumer, the calorific value of the gas—shall not exceed 4,500 calories' (equivalent to 471 B.Th.U. per cu.ft. saturated at 60°F. and 30 in.). This decree referred only to new agreements between municipalities and gas companies. The law of July, 1923, enacted that notwithstanding any conditions contained in existing agreements debenzolisation was to be obligatory and that the calorific value of the gas should not exceed 4,500 calories. This law made it possible to use coke oven gas in urban distributions and not only put an end to the stupid waste of this gas but rendered it possible to erect coke ovens in gasworks themselves.

Manufacture

For the future the problem has been perfectly defined by the report presented by the A.T.G.; it is a question of determining that 'calorific value which enables the distribution to consumers, under conditions of utilisation giving them entire satisfaction, of gas calories at the lowest price.' M. Baril treated the problem under three headings: manufacture, distribution, utilisation.

Gas coal of average quality yields from 320 to 350 m^3/tonne (say, 10,760 to 11,480 cu.ft./ton) at a calorific value ranging from 4,700 to 5,000 calories (say, 482 to 524 B.Th.U./cu.ft.) (on dry carbonisation), a total of about 1,600,000 gas calories. The classic methods of reducing the calorific value are the addition of water gas or producer gas and in special cases oil gas; the systematic introduction of inerts is recognised as bad technique. These methods imply the transformation of a portion of the coke into gas with a C.V. of 2,600 calories (272 B.Th.U.) for water gas and 1,000 calories (105 B.Th.U.) for producer gas. In the limit, that is when the C.V. of the mixture is no more than about 3,200 calories (335 B.Th.U.) one can produce 4 mill. gas calories per tonne of coal using water gas and only 1,800,000 using producer gas as the diluent. If the quantity of heat to be supplied to consumers remains constant when the C.V. is reduced, the total volume to be manufactured is inversely increased with corresponding difficulties, in addition to which the legal limitation of carbon monoxide content of town gas presents an obstacle to the extended use of producer gas and especially of water gas. Further, when gas undertakings are compelled to use these methods by reason of insufficient coal supplies, the price of coke is fatally increased and therefore the cost of water gas may exceed that of the coal gas. From the point of view of manufacture, then, the reduction of calorific value is not necessarily advantageous.

Distribution

With regard to distribution the position is clearer. For a given system, supplying a total quantity of heat to consumers at the rate of Q per unit of time, it can be stated with sufficient accuracy that $Q = K P_c / \sqrt{d}$, where K is a constant, P_c the calorific value of the gas, d its density. If one recollects that the density of coal gas is about 0.47, that of blue water gas 0.58 and of producer gas 0.90 it is at once seen that any reduction in P_c involves an increase in d and consequently a very considerable reduction in Q. If the capacity of the system is more than sufficient to ensure a good supply of coal gas it will be possible to reduce the calorific value of the gas to a moderate extent by the addition of one or other of the diluents. If, however, the contrary is the case—which it is most frequently—the reduction of C.V. will result in a poor supply to consumers particularly at the times of peak load.

Utilisation

From the point of view of utilisation there are two cases to be considered, those of domestic and those of industrial appliances. The former operate at low temperatures. They can accommodate relatively large variations in the calorific value. Their thermal efficiency and their operation remain satisfactory provided that the air supply to the burners is suitably adjusted. It must be recognised, however, that appliances of current manufacture do not always lend themselves readily to such adjustment. The heat output of appliances, like that of the distribution, is, other things being equal, connected with the calorific value of the gas used and its density by the formula cited above: $Q = K P_c / \sqrt{d}$, justly called in 1926 by the Italian engineer, Wobbe, the 'co-efficient of afflux'; consequently, except where appliances are generously proportioned, the reduction of C.V. will result in a sensible reduction in their hourly output of heat.

In industrial appliances working at high temperatures the theoretical temperature of combustion becomes of importance; and we know that this does not vary as the calorific value. That of blue water gas, for example, is higher than that of coal gas. But the thermal efficiency is reduced by the presence of inerts such as are contained in producer gas. The loss can be reduced by the use of recuperation, but this increases the cost of the apparatus so that gas of low calorific value is not to be recommended, at least unless its price per gas-calorie is particularly favourable.

The conclusion is that there is a certain range within which each undertaking, taking its local circumstances into consideration, will be able to choose the most economically desirable calorific value. This range must not exceed that outside which the appliances in use cease to give satisfaction.

It will extend in the majority of cases between 3,800 and 4,800 calories (say, 400 and 500 B.Th.U./cu.ft.). Within these limits the calorific value chosen should be permitted a reasonable tolerance. It is also permissible to change it to permit, in the general interest, of its adaptation to changing economic conditions, such revision being, naturally, accompanied by a corresponding revision of the selling price. M. Baril made a brief reference to the very different cases where gases of high calorific value are available, as in many towns of the U.S.A.

Residual Gases

The third section of M. Baril's presidential address was devoted to a somewhat lengthy treatment of the problems arising in those regions of his own country where advantage is taken of the availability of residual gases from oil refinery plants and of the discovery of deposits of natural gas. He summarised the work done in America and in France on the burning of rich gases and particularly that of M. Delbourg on the critical velocities of flames. M. Delbourg has established experimentally a certain number of laws concerning these velocities and has shown that the laws differ according to whether the flow of the mixture to the outlet of the burner is laminated or turbulent. They permit the construction of a burner for a given gas responding to certain conditions of use and hence the possibility of foretelling the consequences of perturbations caused by a modification of the gas burned. He has evolved a practical and rapid procedure for predicting the consequences of substituting one gas for another and for determining the constants characteristic of any gas, by the use of a specially constructed burner. Observations made so far with this apparatus have confirmed the theoretical conceptions used in its design; it therefore appears to be a very valuable auxiliary in the hands of the technician dealing with these problems. Further research in this direction is being actively promoted by the Committee of the Association Technique de l'Industrie du Gaz.

Finally, M. Baril turned to the future of the gas industry. The most recent statistics, those of 1947, relative to Western Europe and to the United States of America, show that the gas industry in France has not yet attained the same developmen as in other countries of the same latitude and at the same degree of material civilisation. The consumption per consumer in France is only half that in England and less than that in Poland, Czechoslovakia, Belgium, and Holland. The percentage of population served with gas is approximately in the same order. There still exist, even in the Parisian region, buildings and dwellings without gas supply. It is the same in the provinces, where many small towns and villages have no supply. The housing shortage has put a brake on the growth in the number of consumers. The fact that the length of mains per unit area of the country is only one-seventh of that in England and a half that in Switzerland is proof of an abnormal situation leaving room for a big extension in the future.

Plea for Equal Treatment

In this respect the distribution of water and of electricity has received very much better treatment at the hands of the State than that of gas. State subvention has lightened by 70 to 80% the charges on electrification. M. Baril claimed at least equal treatment. But before entering on that road, the selling price of gas should be permitted to return to normal; that is to say, to agree with the stipulations of contracts already in force. It is evidently not possible to pursue the development of a business which is selling at a loss. To give an idea of the situation in the gas industry since 1944, in 1900 the Cie. Parisienne du Gaz purchased 1 tonne of coal for the proceeds of the sale of 104 m^3 of gas, in 1948 this figure was 433 m^3. Great efforts had been made to reduce the annual import of 17 mill. tonnes of coal, by the utilisation of water power, by the up-grading of low-grade coals, by the development of coke ovens, and by the discovery and exploitation of natural gas.

'But our confidence in the future of the gas industry is powerfully based on the talent and ardour of our engineers and chemists.' M. Baril outlined the development of research and of laboratories referred to in a recent abstract (*Gas Journal*, February 8, p. 335). He concluded: 'The use of gas in France has not yet attained the stage of that in a number of other countries. Therefore, its further development is possible. It can be effected by the employment of the national resources, it would provoke an improvement in our commercial balance, it is a national duty.'

NOTES ON INDUSTRIAL ARCHITECTURE

Industrial architecture is complex in character. It involves not only the design of elegant buildings, charming facades, but must also deal with many varied problems ranging from fire prevention to the treatment of ground surfaces, to the choice of colours, to the siting of plantations, &c. M. Maurice Veillon deals with all these aspects of industrial architecture in the work now published in book form by the *Journal des Usines à Gaz*. In our feature 'Gas in France,' we have given brief abstracts of M. Veillon's articles which have appeared during the course of the past year in the columns of our French contemporary; these articles form the basis of the present volume.

The Table of Contents includes, after an introduction and a history of industrial architecture, chapters on steel structures in gasworks, structures in reinforced concrete, the architectural possibilities of brickwork, roof coverings, decorative publicity. There are several chapters of particular interest to the gas engineer on the design of the retort house, coke screening plant, water towers, gasholders and their foundations; and finally a critical study of industrial architecture in Great Britain in which several recent gasworks designs are studied.

The book is the work of a technician who is also an artist. It is abundantly illustrated by photographs and by the author's own sketches which have an individuality and a quality all their own, expressing an intense personal belief in the possibility of realising architectural beauty in the most utilitarian of structures. The keynote of M. Veillon's plea is that this beauty is best attained by simplicity and in designs expressing rather than concealing the purpose of the structure in question, coupled with the belief that the architectural effect of such design has an important moral influence on the life of the community.

Having seen those chapters and the very interesting and artistic drawings which have already been published we can recommend this book, even though, of course, it is available only in the French, to anyone interested in making our gasworks buildings and structures worthy of our industry.

Diary

Mar. 18.—Yorkshire Junior Gas Association : President's Day. **Leeds.**

Mar. 18.—Manchester District Junior Association of Gas Engineers: Meeting Engineers' Club, Manchester, 3 p.m. Address by C. H. Chester, O.B.E., Chairman, South Western Gas Board, President, Institution of Gas Engineers. Annual Dinner.

Mar. 20.—Eastern Gas Consultative Council: Connaught Rooms, Great Queen Street, London, W.C.2, 2 p.m.

Mar. 20.—Women's Gas Council : Executive Committee, 1 p.m. Headquarters Members' Meeting, 3 p.m. Gas Industry House.

Mar. 20-21.—Women's Gas Council : Branch Conference, Gas Industry House, 3 p.m.

Mar. 25.—London and Southern Junior Gas Association : Visit to Wandsworth Gasworks.

Mar. 28.—Southern Association of Gas Engineers and Managers (Eastern District) : 'Practical Aspects of Design and Construction in Gasworks Installation,' S. C. Herbert (South Eastern Gas Board). Gas Industry House, 2.30 p.m.

Mar. 28.—Wales and Monmouthshire Junior Gas Association : Visit to Pontypool Works.

Mar. 28.—Midland Junior Gas Association : 'Moulded Refractory Burners and Tunnels for Industrial Purposes,' W. L. Smirles, B.SC., A.I.C. (Birmingham). Birmingham.

Mar. 29.—Western Junior Gas Association : Visit to new works of Bristol's Instrument Co., Ltd., Weymouth.

Mar. 30.—Women's Gas Council : Joint Meeting of Branches, Gas Industry House, 3 p.m.

April 1.—Scottish Junior Gas Association (Eastern District) : Paper, T. B. Livingstone, Perth.

April 5.—London and Southern Junior Gas Association : Visit to 'Shell' Refineries, Shell Haven, Essex.

April 7 (Good Friday).—North British Association of Gas Managers : Spring Meeting, Ardrossan.

April 14.—Institution of Chemical Engineers : 28th Annual Corporate Meeting, May Fair Hotel, Berkeley Street, London, W.1, 11 a.m. Annual Dinner, Ball Room, 7 for 7.30 p.m.

GAS QUALITY AND APPLIANCE PERFORMANCE*

By LESLIE T. MINCHIN, B.Sc., M.Inst.Gas E.

***EDITOR'S NOTE*:—The author comments that many fresh linkages are being planned between undertakings which were formerly independent. On the other hand, new sources of fuel are becoming available. He contends that the flame in the consumer's appliance is the ultimate aim of all gas manufacturing processes. Mr. Minchin wants to change the calorific value criterion to something more fundamental. He places his faith in the Wobbe index. Others fail to share his optimism.**

A SERIOUS charge I would make against the old Gas Acts is that they set up a new god—the gas calorimeter—which it became one of the engineers' duties to propitiate. Methods of works procedure which were not particularly desirable from the customers' points of view were, nevertheless, sometimes adopted if the calorimeter gave its blessing.

If we criticise the excessive concentration on calorific value, what is the alternative criterion we should advocate? Much the simplest of the alternatives available is the Wobbe index, and the adoption of this quantity as the fundamental criterion of gas quality would in my opinion be a very great advance.

One of the fundamental needs of the gas appliance user is that the thermal input to his machine should be constant. However, the present practice in some undertakings of sending gas out at constant C.V. but widely varying sp. gr. results in a variation in heat input to every appliance proportional to :

$$W = \frac{\text{cal. val.}}{\sqrt{\text{sp. gr.}}}$$

where W is the Wobbe index, a measure of the number of B.Th.U./min. which will pass through a given orifice at a constant pressure. A big variation may be a considerable handicap to the precise utilisation of town gas.

One very large undertaking announced very recently that the specific gravity of its gas varied between 'under 0.4' at periods of low demand to 'over 0.6' at peak periods. Expressed in terms of heat input, this means that at times when the weather is particularly cold the number of B.Th.U. taken by an appliance is nearly 20% less than would be consumed when the weather is warm and demand for gas is reduced. (This calculation assumes a constant pressure governor to be fitted—a slight complication which has been embodied in the apparatus with the specific intention of maintaining the thermal input constant.)

The importance of these variations can most clearly be seen by reference to instantaneous water heaters. As is well known, these are normally designed to deliver water at about 140° F.; much higher temperatures are undesirable because of scale formation. With the water inlet at the average temperature of 55° this 85° rise gives good service for baths and for washing-up, but there is not much latitude available; water delivered at 110° is too cold for either purpose.

Since the water inlet temperature may fall by 15° there is only a margin of some 10° remaining within which heat input may fall without great inconvenience to the housewife. This represents some 12% allowable variation, but all of this cannot be allocated to gas quality. There are manufacturing tolerances on the apparatus which cannot be further reduced without considerable rise in price, and the age of the appliance and atmospheric conditions must all be reckoned with. The problem is difficult, but given a gas of constant Wobbe index good service can be given. With really large variations in Wobbe index a satisfactory result becomes virtually impossible.[17]

A similar argument can be applied to many other appliances, though the degree of importance of an accurate control of heat input varies. Industrial apparatus is often rather vulnerable as, for instance, the muffle furnace which is designed to reach a temperature of—shall we say—1,000° C. Evidently the design temperature will not be reached unless the correct heat input is available, and at 100° lower the furnace may be useless.

If there is a fall in Wobbe index, we have to reset our Boys calorimeter to compensate for it. We open the control cock a little further until the gas rate as shown on the wet meter once again falls within the prescribed limits.

Having done this, we proceed to measure the calorific value of the gas. But we have made an adjustment which the district consumer cannot and will not do; he has not a wet meter and stop-watch in front of him and must take the heat input of his appliance as he finds it. We are deluding ourselves if we thing that a constant calorific value measured in this way means constant service to the consumer; before we can give that we must set out to supply him with gas of constant Wobbe index letting C.V. and sp. gr. vary as convenience dictates.

With gas manufacture as carried on at present, I believe such a change in the procedure would be highly advantageous to the performance of gas appliances, and it is very probable that the much more difficult controls on A.T.B. No., flame velocity, &c., would no longer be necessary unless quite unusual methods of gas production were employed. It would also put an end to the strange situation we are accustomed to at present, whereby a sudden cold spell is apt to send the sp. gr. up and the Wobbe No. down—so that the heat input to all appliances is lowered just at the time when a high input is most needed.

Before the reform could be put into operation some modification would be desirable in the Gas (Quality) Regulations, 1949, though something could be done even within the limits of C.V. laid down therein. For instance, with a 500 gas having a normal specific gravity of 0.45, a constant Wobbe index could be maintained over a range of 0.40 to 0.50, as follows :

Sp. gr.	C.V.	Wobbe Index	
0.45	500	745	normal gas
0.40	475	750	(bottom limit C.V.)
0.50	525	742	

However, since it is hardly practicable to work on the − 5% limit for long, some modification of the regulations would be desirable, and for undertakings whose specific gravity varied more than this it would be essential. There may be practical operational difficulties involved, but, if so, I am convinced they should be tackled as soon as possible.

Combustion Characteristics

So far we have discussed the thermal input to gas appliances without considering the stability of the flame which burns inside them. Evidently our foolproof gas appliance must not only have the correct amount of thermal input as reckoned from (C.V. × gas rate), but there must also be a stable flame of constant shape inside which will assure correct functioning.

* A paper to the Southern Association of Gas Engineers and Managers (Western District) on January 19, and (Eastern District), on February 28, 1950.

Although non-aerated burners have replaced bunsen burners to some extent of late years, it still remains a matter of paramount importance that the low-pressure aerated-burner flame shall remain constant in shape and character. One day, perhaps, a given burner will give the same kind of flame not only at different times and places on the area of one undertaking, but over the whole country.

Meanwhile, until that happy day dawns, it ought to be possible to be sure that a given appliance once fitted will give trouble-free operation, even though some adjustment may initially be necessary on account of the local characteristics of the gas supplied.

In practice, the behaviour of an aerated burner flame is largely characterised by the shape of its inner cone. If that can be maintained constant, it is highly probable that the appliance will continue to function as it did when first installed. A shortening of the cone may lead to excessive noise and ultimately to lighting-back; lengthening, to reduced efficiency, incomplete combustion, and possibly carbon deposition. Even if an aeration control is embodied in the appliance it is most undesirable that we should encourage the consumer to attempt such an adjustment himself; the present tendency is to design any such controls so that they cannot easily be moved by the owner.

The height of the bunsen cone represents a precise balance between two opposing velocities; these are the rate of efflux of the air-gas mixture and the speed of flame propagation in that particular mixture. The first of these qualities is sensibly constant if the heat input is controlled and the tap is fully open, but the speed of flame propagation depends upon the composition of the gas and—very much more—on the proportion of air present.

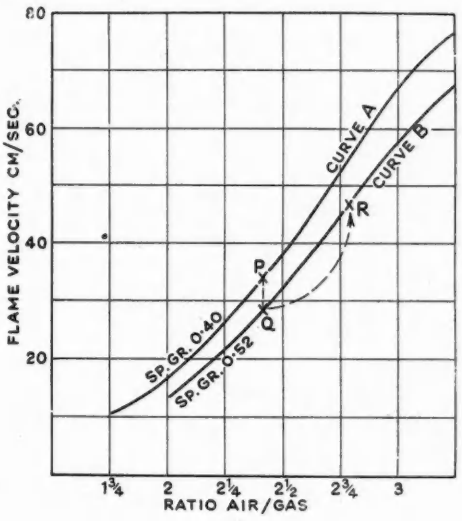


Fig. 1.

The two curves of Fig. 1 show the flame velocity of two quite typical manufactured gases, plotted against the ratio of air : gas and it will be seen that a change in air-gas ratio from 2 : 1 to 2.5 : 1 (or from 33% to 29% of gas in the mixture) can easily cause the flame velocity to double itself. Changes in air-gas ratio can come about as a result of a change in the specific gravity of the town gas, which in itself will cause an alteration in the flame-velocity curve; so that for any change in gas composition one may move from one point on one curve to another point *on a different curve.*

Although this makes consideration of the problem rather complicated, it also brings about a process of compensation without which our problems would be very much more acute. By good fortune, a rise in specific gravity is usually accompanied by a fall in H_2 content; and these two changes have opposite effects.

(a) The maximum flame velocity will *fall,* because the hydrogen has a very much higher flame speed than any other gas.

(b) The air-gas ratio which, for a given burner adjustment, depends on the specific gravity, will rise; so that the conditions under which the combustion is actually occurring are higher up the new flame-velocity curve. On this account the flame speed tends to increase.

As can be seen from Fig. 1, the net effect of both these changes may well be that the actual flame-velocity of the air-gas mixture in a given burner is not greatly altered, and the cone-height may remain approximately the same. This is the case, for instance, if one substitutes CO for H_2 in a 500 C.V. mixture with methane. If, however, one considers actual gas production, one finds that the change from dilution by producer gas or B.W.G. to dilution by C.W.G. gives rise to an increase in sp. gr. without much decrease in H_2 content. (C.W.G. contains heavy hydrocarbons of the olefine series, which also have a high C.V. so that a high H_2 content and a high sp. gr. then become compatible.)

Dilution with producer gas, blue gas, or waste gas will increase the sp. gr. of a mixture, but it will cause the H_2 content to fall at the same time, so that the rise in air-gas ratio is largely compensated for. Moreover, the C.V. of these low-grade gases being fixed, the amount one can add is strictly limited.

These are the general reasons why C.W.G. has a more serious effect on the inner cone of the aerated burner, but they may be stated quantitatively by the method shown in Fig. 1. From an initial position on curve A at the point P, the gas properties change so that the curve B now represents the flame velocity in relation to air-gas ratio.

If the air-gas ratio remained constant, this would cause a drop in flame velocity to point Q, but, in fact, the air-gas ratio is increased and the final condition is therefore represented by point R, on curve B, but higher up. Such a rise in flame velocity means an almost proportionate fall in the height of the inner cone, and may lead to the flame becoming quite unstable and lighting back.

The ratio of the heights of points R and P above the axis is nearly equal to what has been known as the 'D factor,' and one could hardly wish for a more reliable and fundamental index of the change in the behaviour of an aerated low-pressure burner in changing from one gas to another. To arrive at D, however, one has to determine the flame velocity curves of both gases. Before the war an apparatus was available in Germany by means of which flame-velocity curves could be prepared very quickly.

As far as I know this 'Dommer' flame-velocity apparatus is not in production at the moment, but it should not be very difficult to construct if the need arose. A method of deducing the ratio of cone heights—the 'D Factor,' in fact—without the determination of flame-velocity curves has recently been developed in France.

There are a number of other ways in which combustion characteristics can be described diagrammatically, and it is interesting at this point to review them in turn. One of the simplest is by the use of what J. Wood has called 'Chaso' curves—a somewhat exotic name which embodies the initial letters of the two quantities plotted—Cone Height v. Air Shutter Opening.

Fig. 2 shows three of these curves from the 52nd Report[3] in which the cone-heights of three gases of increasing C.W.G. content are shown plotted against the opening of the air port on a standard aeration test burner. The downward-pointing arrows indicate the point of flash-back. If one adjusts the burner on the first gas (21% C.W.G.) to a normal cone height and then switches over to 50% C.W.G. without altering the burner the cone height will clearly decrease from 1.9 cm. to 1.1 cm.—*i.e.*, it is getting dangerously short.

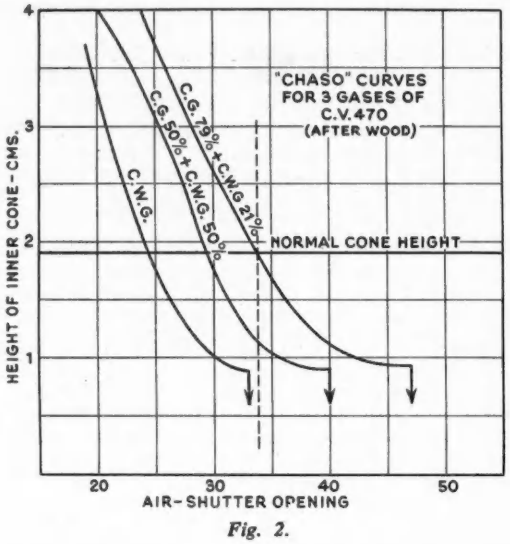


Fig. 2.

If one now changes to pure C.W.G. one can no longer get a flame at all, for the burner will flash back when one attempts to light it. Similarly, one could demonstrate the increased length of cone if adjustment were initially made on C.W.G. and changes were then made over to the 'softer' gases.

Although this is a valuable demonstration of the actual behaviour to be expected from gases on district appliances, flashing back will occur sooner than these curves would suggest. 'Chaso' curves are made on a burner which has a long straight tube which produces a very steady flame suitable for measurement. Fuidge has shown[4] that the chance of lighting back is greatly increased when one moves over from such an ideal burner to a practical gas appliance. The Rochester test burner[5] is apparently better in this respect, but it is correspondingly less easy to read the cone height.

A more thorough method of representing combustion characteristics is by means of the 'combustion diagram' as employed first by the U.S. Bureau of Standards and more recently by Fuidge and his collaborators in this country[4, 4a]. Fig. 3 shows two diagrams, the upper for a mixture approximating to coal gas and the lower to C.W.G. The co-ordinates represent heat input and air-gas ratio. Such diagrams are prepared by using metered supplies of gas and air so that the air-gas ratio can be varied at will; one can explore every possible ratio at all rates of heat input and chart the areas of stable flame, of yellow tips, and draw in the boundaries of flash-back and blow-off.

Such a survey may, of course, include conditions which are never likely to be encountered on an atmospheric burner in practice, so Fuidge plots 'aeration curves' on the same diagram to indicate how aeration varies with heat input when a practical burner is subjected to varying inlet pressure. The greater tendency of the C.W.G. mixture to light back is now shown by the larger area of the 'flash back' zone in the lower half of Fig. 3. Since the C.W.G. mixture has a higher sp. gr. the aeration curve corresponding to a given size of injector nipple will lie higher up and nearer to the flash-back zone, and on this account, too, the flame is less stable.

Test Burners

The several approaches we have just described are all valuable in helping the physicist-chemist to understand the relative behaviour of different gases in a burner, but it is not surprising that a need has been felt for a single number to express the cone-height-producing powers of a gas. Such a simple number cannot be expected to convey all the information which is contained in a combustion diagram, and at best it can only represent the behaviour of the gas in one type of burner. However, if this burner is the ordinary low-pressure aerated burner drawing in about 50% of the air for combustion at the injector, such a number can be extremely useful.

It is this need for a simple numerical reference standard which has given rise to the 'test burner' in its various forms; a simple bunsen burner with a calibrated air shutter which is opened either till the inner cone of the flame reaches a standard height or until the flame flashes back.

On the Continent a little burner designed by Professor Ott, of Zurich, was probably the first apparatus to be produced, and this is still very widely used. The 'aeration test burner' was designed by me in 1937 when I was working at Watson House for the Gas Light and Coke Company; I wished to avoid some of the uncertainties of the Ott burner and to establish a reproducible British standard.

In the U.S.A. the same need was felt a little later, and Shnidman and Yeaw introduced the 'Rochester test burner' in 1940[5]. A much more precise and elaborate instrument was on sale in Germany before the war, known as the 'Czako-Schaak' apparatus, but in spite of its periscope mirrors and other refinements it is doubtful if it was any more accurate than the British A.T.B. Moreover, great accuracy is not required in an apparatus of this kind; it may, indeed, be actually misleading.

When the aeration test burner was modified in 1939 and the model B introduced, opportunity was taken to make the scale coarser so that there would be less tendency for undue attention to be given to small variations. However, this change, which was necessitated by certain constructional difficulties in the A type, had the unfortunate effect of introducing a fresh scale before the first one had become properly established.

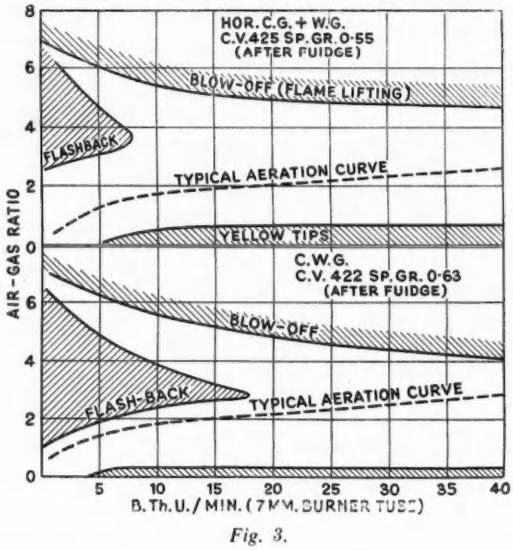


Fig. 3.

The onset of the war made it more difficult to produce such burners, so that both A and B scales have persisted side by side. In the interests of standardisation, it is certainly to be hoped that the B type will now become generally available again and the A scale be discontinued.*

The design of a test burner would seem to be a very simple matter; in fact, both the Ott burner and the Rochester burner are ordinary laboratory bunsens to which a little extra care

* A curve showing the relation of the two scales is to be found in the 44th Report of the J.R.C. (*J.G.E. Trans.*, 89, 49, (1939). Readings on the A scale are approximately double those on B scale but the ratio falls to about 1.8 in the middle of the range.

† Indeed, Warren Churchill made up a 'Rochester' burner for use in Boston, U.S.A., in which the air-shutter was arbitrarily soldered into such a position that 100 corresponded to normal gas.

has been given in manufacture.† It is when one attempts to prepare a design which shall be really reproducible, so that a dozen burners made at different times will all give the same test result not only on one gas, but on several different gases, that the cost and complication increases. However, it is evident that a standardised scale is highly desirable, and the B type A.T.B. was designed to give identical readings with the standard burner, without any adjustment at the makers' works.

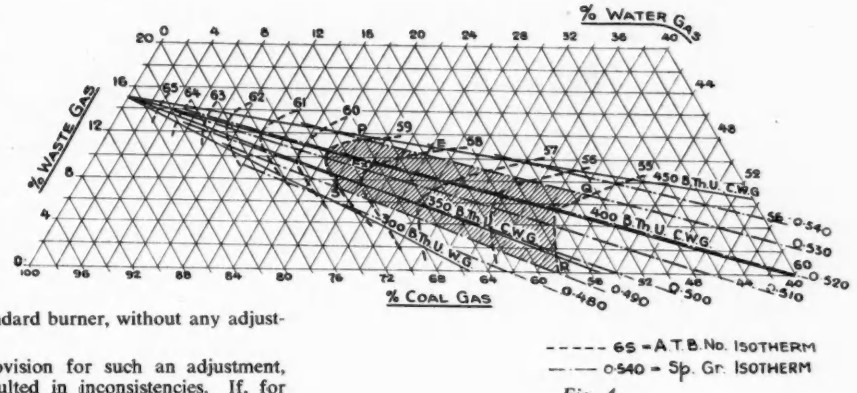


Fig. 4.

The earlier model had provision for such an adjustment, and it was found that it resulted in inconsistencies. If, for example, one corrected for a somewhat undersized injector by putting more restriction in the burner, the correction might only apply to one particular gas; on another gas mixture of the same A.T.B. number a different correction might be needed. Indeed, this question of the size and shape of the injector orifice is the Achilles' heel of the test burner. Real reproducibility demands that the gas rate shall be correct ±1% at least, and this is quite a difficult matter to achieve when the rate is only 3½ cu.ft./hr.

Fortunately, however, there is a new demand growing up for accurately drilled small holes, as a result of the development of the bottled-gas industry in this country. In a new test burner I have designed recently I have employed this type of injector, and there is good reason to suppose that some of the difficulties experienced in the past will thus be overcome.

The new burner—model C would seem the obvious name for it—will not call a fresh scale into being, for it is capable of being calibrated on the same scale as the type B instrument. It employs a much more robust and simple construction for the air inlet and the gas rate is set at the rather higher rate of 5 cu.ft./hr.—which should facilitate standardisation. The mirror scale is replaced by a metal ring; the standard height to which the inner cone is set is 1 in.[18]

The first test burners had fixed air-ports and the measurement was then made by noting the length of the flame inner cone. One disadvantage of this is that it is difficult to make a burner which will operate satisfactorily, giving a measurable cone, on gases of all grades. Even if one does succeed in making the same burner, without alteration, operate on a wide range of gases, it is evident that one will be employing quite unusual parts of the flame velocity curve for the extreme types of gas.

A compromise between the fixed and variable air-port types has been suggested by J. W. Wood[3] in this country and by Yeaw and Shnidman[5] in the U.S.A. This proposal is to use a variable air-port test burner, the shutter of which is locked in a position corresponding to the normal average test burner number for the gas. Once this has been done, the cone height only is measured; Yeaw and Shnidman found that pure C.W.G. at 540 C.V. gave a cone height of 0.4 as against 1.0 for normal town gas of the same C.V.

This method of working has some advantages, as it shows the variation in cone height directly; it is not safe, however, to go further and assume that if the test burner does not light back, an ordinary appliance will burn satisfactorily. The range of conditions within which lighting back takes place is much wider on a commercial burner and, to take the above-quoted example, many appliances would not stay alight if the cone height shrank to 40% of the normal setting. Nor, in fact, will the British A.T.B., which works to a rather shorter normal cone (see Fig. 2).

A somewhat similar idea lies behind the 'flame matching burner' which is used by the North Thames Gas Board and is issued to their fitters. This is simply a portable test burner made to give a normal flame on the average gas made by the undertaking. The fitter is instructed to set the flame cone on the gas appliance short or long according to whether the test burner cone is short or long.

The absence of any sort of scale on this burner would seem to make its use rather unnecessarily difficult, but no account of its operation in practice has yet been published. One would expect considerable difficulty to be experienced in making so small a burner reproducible. Presumably the A.T.B. is used to calibrate the 'flame-matching burner' in the first case. An essential pre-requisite of any such scheme is that the undertaking should first lay down a normal A.T.B. No. for their average gas.

Gas Composition and Combustion Characteristics

The relation of combustion characteristics—whether they be represented by A.T.B. No., Chaso curves or combustion diagrams—to the gas analysis is a most complicated subject which has been dealt with very thoroughly by Fuidge and his collaborators and by J. W. Wood, as well as by workers in France and the U.S.A.

One of the difficulties lies in the fact that combustion characteristics are a whole complex of properties which cannot be reduced to a number except by the simplification of using the A.T.B. Also the gas composition has some seven variables, and to this must be added such quantities as sp. gr., air requirement and C.V. which depend upon the composition but seem to have an influence of their own as well. Nevertheless, the problem must be faced, however difficult it may be, for unless one knows how gas composition affects combustion characteristics it is difficult to forecast the effect which any new modification in the manufacturing process will have on the quality of the gas.

The mind of a chemist naturally turns to triangular diagrams in such cases, and in 1937, in the discussion on the 40th Report at the Institution meeting, I put forward a method for plotting the A.T.B. No. in terms of the content of the H_2, CH_4, CO, C_nH_m, and inerts. The data were very incomplete and the method of reading the diagram so complicated that I doubt whether anyone but myself ever followed it!

Some years later, Mr. Fuidge, in his second paper, put forward a much more practical method of representation by treating coal gas, water gas, and waste gas as his three constituents and regarding all manufactured gases as a mixture of these three. His diagram—reproduced in Fig. 4—affords a practical method of assessing the effects of water gas and produced gas dilution on coal gas mixtures. Such a simplification is evidently only applicable to straightforward mixtures, and if only these are to be considered, Mr. Wood's approximate curves connecting C.V. and A.T.B. No. are rather more convenient to use.

W. J. G. Davey has recently[9] suggested that the A.T.B. No. can be derived from the Wobbe index by the empirical formula,

$$\log W = 2.07 + 0.5 \log B$$

where W = Wobbe No. and B = A.T.B. No. (B scale).

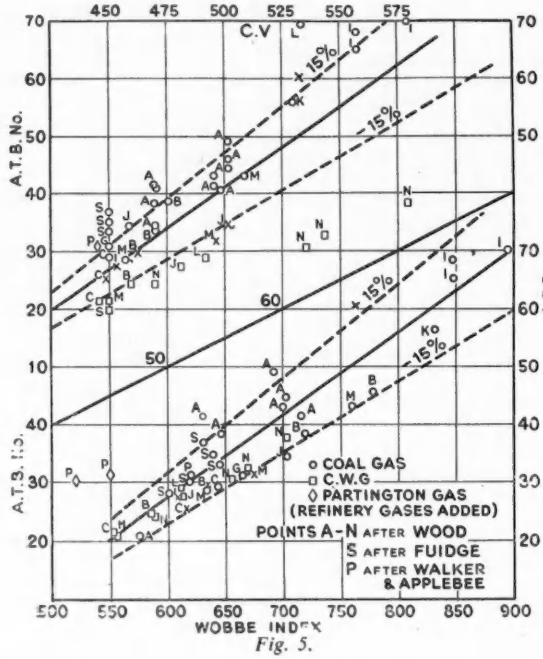


Fig. 5.

Examination of his original curve shows that the spread of the points is quite wide, and if more points are calculated from other sources the spread becomes wider still. Furthermore, a study of the data contained in Fuidge's diagram, Fig. 4, does not confirm the generalisation at all. Nevertheless, although there is no strict relationship, the A.T.B. No. follows the Wobbe index a good deal closer than it follows the calorific value, as will be seen from Fig. 5. Here a considerable number of test results collected by Wood[5] have been plotted against both quantities.

In the upper half of the diagram, where A.T.B. No. is plotted against C.V., the disparity between coal gas (circles) and C.W.G. (squares) is very evident; at 500 C.V. the A.T.B. No. can vary between 30 and 50 and at higher readings the spread is greater still. The letters A-N indicate tests from the Wood survey, all on practical works gases; S indicates some of Fuidge's results which were obtained on artificial mixtures made up in the laboratory. P is used to denote one or two results obtained at the Partington works of the Manchester undertaking where refinery gases are added[7] (shown as diamonds).

When one comes to the lower half of the diagram, one finds that although Wobbe No. is evidently not a simple function of A.T.B. No., nearly all ordinary commercial gases lie within the ±15% limits shown as dotted lines. Fuidge's made-up C.W.G. and the Partington gases are the only points far outside. Circles and squares are now very close, and the three tests from works N on high-C.V. C.W.G. now fall into line with the coal gas, though they were very far out on the upper diagram.

It would seem that one could probably replace ordinary town gas by 100% C.W.G. quite safely if only the present C.V.-control system could be replaced by Wobbe index control. It was for this reason that I suggested earlier that the adoption of a Wobbe No. criterion might make the more difficult control of combustion characteristics less necessary. This principle has already been recognised to some extent, for one large undertaking at least stepped up its C.V. from 500 to 520 a short while ago to cover a period of extreme coal shortage and high C.W.G. production. This measure was introduced with the specific intention of avoiding a fall in Wobbe No. and A.T.B. No. which might have had serious repercussions on the district.

Many gas engineers in America have used a similar principle, basing their gas quality on a formula developed by Frank Knoy, of Los Angeles.[20] This criterion is a slight modification of the Wobbe index—*i.e.* (C.V.—175)/√sp. gr.—and does not appear to have any special advantage.

There still remains the problem of prophesying the behaviour of gases of unusual composition before sufficiently large quantities are available to make a practical test possible. This is a need which is likely to become more acute as new sources of gaseous fuel become available. A clever method of tackling this problem graphically has been developed in France by Gaudry and Gouffé for propane mixtures,[10] and applied to a whole series of oil-gas mixtures by Renauldon and Delarozière.[11]

In each case a diagram such as that shown in Fig. 6 is prepared, on which are drawn a series of lines to represent the change in C.V., sp. gr., Wobbe No., &c., as one moves from 100% of one gas mixture to 100% of the other. Two more curves are next drawn; one (5) shows the change in the maximum flame velocity (*i.e.*, at the optimum air-gas ratio), and the other (4) shows the change in per cent. gas in the burner mixture (divided by the percentage which gives maximum flame velocity).

Curve 5 can be calculated by the method of Payman, which is a well-known approximation quite accurate enough for this purpose.* The air-gas ratio can be calculated simply enough by assuming that it varies as the square root of the specific gravity. Knowing the air-gas ratio for maximum flame velocity, the curve 5 can be drawn to show the degree of aeration which a standard burner would give if set to have a good stable flame on the type of gas to which the district is accustomed.

One next has to find how the flame velocity on an actual burner varies, and to assess this one erects a flame-velocity curve on the left-hand side of the diagram as shown. This is a generalised curve, obtained by plotting the flame velocity curve for a whole series of gases against common co-ordinates, *i.e.*, flame velocity as per cent. of maximum, and per cent. gas in mixture divided by per cent. gas for maximum flame speed.

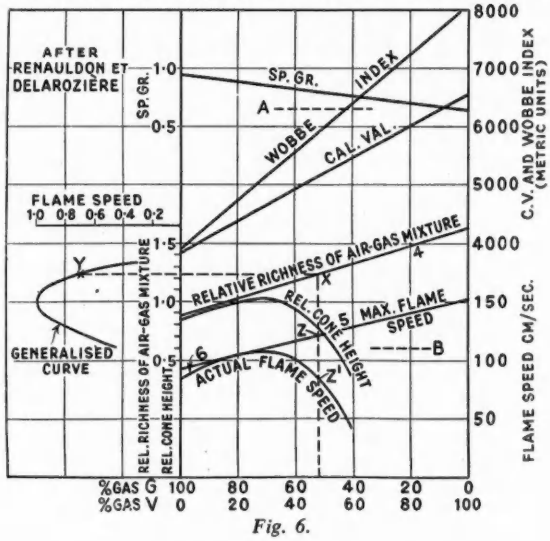


Fig. 6.

The curves plotted in this way lie so close together that an average curve can be drawn, and it is this which is plotted to the left of Fig. 6. One can now proceed to construct the new line curve 6 which shows the variation in flame velocity of the gases in a burner by the following construction:

(a) From a point X draw horizontal XY to show the flame velocity corresponding to this degree of aeration—say the result is 0.7.

(b) Drop a vertical line from X to intersect curve 5 at Z. This shows the *maximum* flame velocity for this mixture

* This is described in the 40th Report of the Joint Research Committee.

(*i.e.*, when mixed with the optimum amount of air).

(c) Extend the line XZ to a point Z′ such that Z′ is at 0.7 times the height above the base line of Z (0.7 being the flame velocity we have read off from line XY).

The point Z′ shows the actual flame velocity in a burner, and a complete curve of such points can now be drawn showing the variation of this quantity over the whole range of gas compositions covered by the diagram—or as much of it as will give a measurable cone.

To make use of such a diagram, once it is constructed, one only needs to know the Wobbe No. and flame velocity curve of a normally burning mixture corresponding to the gas on which the district appliances have been initially adjusted. If such limits are shown by the lines A and B on Fig. 6, then it is clear that to obtain the desired Wobbe No. (6,300—in metric units—corresponding to a gas of C.V. 475 and a sp. gr. of 0.5) one needs a mixture of 43% G (oil gas) and 57% V (high C.V. coal gas—presumably from L.T. carbonisation). At this mixture, however, the flame velocity has ceased to exist—the flame has no inner cone that is measurable, and the flame if it could be measured would be less than 36% of normal. Evidently, such a gas would be quite unsatisfactory, for there would be low efficiencies, soot formation, excessive CO formation, and so forth.

If, however, one can accept a lower Wobbe No. of 5,400 (which corresponds to a C.V. of 420 and a sp. gr. of 0.5) then the mixture containing 40% of G has much better flame characteristics, for its flame velocity is now some 90% of the desired value, and a lengthening of cones by about 10% is all that need be feared. In this way it seems to be possible for really practical results to be deduced from an analysis of the gases concerned. If mixtures of three component mixtures have to be considered, it would seem necessary to have a series of such diagrams, one of the components plotted along the bottom of the diagram being a binary mixture.

Flame Lifting

Although this French method is, in some ways, most attractive, there is one serious omission to which attention should be drawn. The height of the inner cone is forecast by this procedure, but there is no indication as to the possibility of the flame lifting, nor does it give any information on the stability of a Bray jet. This is unfortunate, for flame lifting is one of the most frequent troubles in mixtures of unusual gases ; it can occur even though the inner cone is exactly of the height desired. Walker and Applebee[7] have recently described how the addition of a mixture of refinery tail gases and producer gas to the normal coal gas made at Partington works, Manchester, gave rise to considerable difficulties of this kind although the A.T.B. No. was scarcely changed.

In general, the use of a lower flame-velocity gas of higher specific gravity—*i.e.*, one containing less hydrogen—even if it gives rise to a cone height similar to obtained with the reference gas, is liable to cause trouble in this respect. An increase in the air-gas ratio may have offset the drop in the maximum flame velocity of the mixture, but flame-lifting occurs very much more readily when the air-gas ratio is at or near the theoretical air requirement for complete combustion,[12] and an increase in specific gravity (without change in C.V.) necessarily means a higher air-gas ratio even though the cone height may not have changed.

A switch over to a slower-burning gas—say, for example, producer gas + methane—if it did not alter the height of the inner cone would certainly have brought the air-gas ratio very much nearer that corresponding to complete combustion, and therefore made flame lifting more likely. Von Elbe and his collaborators[13] have shown that flame lifting also depends on the velocity gradient just inside the burner mouth, but since the volume of air entrained is independent of gas specific gravity it is not easy to see how this quantity can be greatly affected by gas quality.‡ When we know enough about the subject to be able to calculate an additional line to Fig. 6 indicating the blow-off tendency of the mixture, we shall have made great progress.

‡ The American Gas Association have developed a 'lifting index' of considerable complexity, but this is so empirical that we may well have doubts as to whether it would be applicable to any gas mixtures other than those used in its development.

Performance of Practical Appliances on Varying A.T.B. No.

The complaint has often been made that the statement 'the A.T.B. No. of a gas has increased by x units' or 'decreased by y units' tells one nothing as to how gas appliances will behave. This is not quite true, except in so far as it means that the last section of the 44th Report of the Joint Research Committee[14] has been generally overlooked. Table 4 in that report gave a full summary of the effects of A.T.B.N. variation on typical gas appliances, and is summarised below.

Appliance	Fall in ATBN		Rise in ATBN	
	% change	Principal defects caused	% change	Principal defects caused
Gas fires	13 to 40*	Partial fireback to discs when first lit. Complete flash-back on lighting. Flashback when turned down. Excessive noise	20	Poor appearance and tendency to incomplete combustion
Street lamps	13 to 28*	Partial flashback to disc	10	20% reduction in light output
Cookers and other ring burners	27 to 40*	Flashback especially when turned low in draught	20	Tendency to incomplete combustion

* According to type.

It will be seen that a variation of −13% +10% would produce next to no ill-effects, or if one cares to disregard the light output of street lamps the limits could be −13% +20%. It must be remembered, however, that the 'normal adjustment' in these cases was done by means of a ruler in the laboratory ; very much depends on how this 'adjustment gas' setting is made. Ideally, it would be a good thing if outlet gas could be kept within +10% −10%, and we have already shown that the introduction of Wobbe index control on the works would very nearly achieve this result.

It is important in all cases that a central norm should be established to which appliances are to be set initially. It may still be necessary for the fitter to carry his 'flame-matching burner,' or some such apparatus, to ensure that appliances are adjusted with regard to this central norm.

There is a common fallacy that sensitivity to change in gas quality is a property of modern appliances only, due to over-refinement in design. The simplest answer to this suggestion is to point to the lighting burner which is the most sensitive of all. Methods of designing burners for maximum tolerance will be referred to in a later section.

Limitations of the A.T.B.

We have already mentioned several of the limitations on the usefulness of the aerated test burner which must be borne in mind. Summarising :—

(1) It only deals with flame stability in ordinary atmospheric burners which entrain about 50-60% of the air for combustion at the injector. It is not a guide to the behaviour of either high-pressure burners (working at 100% air) or (still less) to forced draught burners.

(2) It gives practically no indication as to the behaviour of non-aerated flames. The 52nd Report actually contains a graph relating A.T.B. No. and length of a luminous rat-tail flame, but the correlation is very poor and may indeed be fortuitous.

(3) The burner gives very little information as to the likelihood of flame lifting or blow-off. It is true that if a stable flame could not be obtained on an A.T.B. one would justly condemn the gas for general use ; but the reverse is not true. The careful streamlining of the flow in the burner decreases the velocity gradients at the rim and causes the flame to be more stable than a commercial burner would be. Churchill[15] has advocated that three separate measurements should be made with the test burner ; air port opening for (1) fixed cone

height, (2) for 'yellow tips,' and for (3) lighting-back or blow-off. This is a procedure which might be useful, but the objections we have mentioned still remain.

The effects of gas quality on 'Bray' and pin-hole burners is a subject so little explored that there is really no systematic body of knowledge to draw upon. Much the most valuable data are contained in the survey carried out by Fuidge and his colleagues,[4] but Wood,[3] Delbourg[14] and the A.G.A.[15] have studied the effect of gas composition on flame length.

There are at least four ways in which a non-aerated burner can be affected by changes in gas composition :

(a) The flame can vary in length, affecting the efficiency and the completeness of combustion.
(b) The flame can deposit soot, even without any lengthening.
(c) The flame can begin to roar, becoming at the same time distorted in shape.
(d) The flame can lift. This usually takes place in two stages as the pressure is raised ; 'incipient lift point' when there is a gap between burner and flame, and a further stage at which the flame floats off completely.

(a) *Flame Length.*—Roughly speaking, there is no doubt that the length of a pin-hole flame depends on the amount of heat being liberated. Delbourg[14] has deduced the empirical formula :

$$h = D.q_c$$

where h = flame height, q_c is the heat input in cal./hr. and D is a constant depending on the kind of gas and the distance apart of the holes. For single holes, D has the following values :

Town gas, 0.042. Natural gas, 0.048. Butane, 0.053.

From this one would expect the flame length to depend on the Wobbe index, since this is itself a measure of the amount of heat liberated by a burner. A plot of Wood's results for flame length against Wobbe index (Fig. 7) suggests at first that the correlation is only slight, but a more careful examination shows that the position of the points on the diagram has some relation to the method of production.

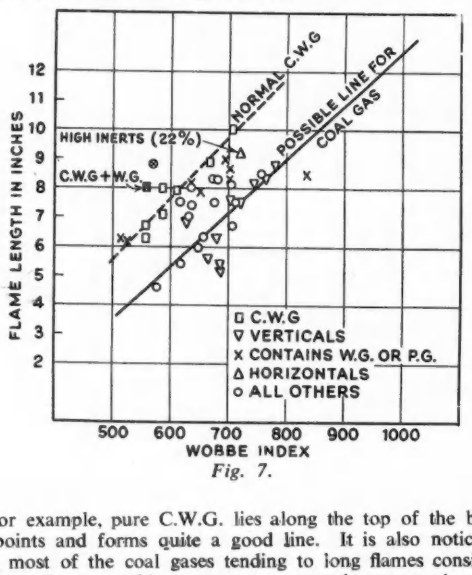


Fig. 7.

For example, pure C.W.G. lies along the top of the bunch of points and forms quite a good line. It is also noticeable that most of the coal gases tending to long flames consist of horizontal gas + either waste gas or producer gas—*i.e.*, mixtures which are high in inerts. The coal gases giving shorter flames consist of vertical gases (steamed) or horizontal gases with B.W.G. added—*i.e.*, mixtures likely to be low in inerts.

In this group also falls the isolated case of a mixture of B.W.G. and methane. It seems quite probable, therefore, that one could work out a series of factors, as Delbourg has done, which might bring the flame-length into much better correlation with the Wobbe index. These comments refer only to the pin-hole type of burner—there seems to be practically no information on the variation in size of the flat-flame, though it is certainly much less.

(b) *Deposition of Soot.*—There seems to be no doubt that heavy hydrocarbons such as benzene or propylene tend to cause soot deposition on a solid surface even if the flame does not lengthen. Fuidge has recorded that both benzole-containing coal gas and pure C.W.G. are troublesome in this respect, but the subject still awaits qualitative treatment.

(c) *Flame Roaring.*—This is essentially an aero-dynamic phenomenon, and is due to the sudden change from stream-line to turbulent flow in the burning gases. Wood[3] has shown it to have no relation to A.T.B. No. whatever, and this is hardly surprising. If the roar-point has any relation to gas quality, it is likely to be connected with the viscosity of the gas mixture and the temperature (and hence density) of the flame gases.

(d) *Flame Lifting.*—This phenomenon is essentially similar to flame lifting in an atmospheric burner ; here, too, it becomes serious when flame velocity falls, usually as a result of a drop in hydrogen content. Plotting Fuidge's results for commercial gases with a 000 Bray jet, there appears to be quite a good correlation between the pressure at which flames lift and the Wobbe Index of the gas. Although these six test results include a C.W.G. which falls on to the line quite well with the coal gases and coal-producer gases, the number of points is too few to enable one to draw any serious conclusions. It is of interest to note that pure H_2 and pure CO lie quite near the curve ; pure CH_4 is nowhere near it. It is a matter of common experience that ordinary domestic gas appliances using Bray jets sometimes give trouble owing to flame lifting in districts where the inerts content of the gas is high, and the Wobbe index, in consequence, is probably low.

Appliance Design and Tolerance

It is the usual defence of the gas engineer, when people bother him about combustion characteristics, to say : 'You go and design your gas appliances so that they are less sensitive.' To what extent is this reply justified ?

Evidently no modification of design today will affect the bulk of the appliances on the district for many years to come ; our gas supply goes to consumers whose appliances are up to 30 years old. Nevertheless, if there were some simple way of making burners less sensitive to changes in A.T.B.N. we ought to start taking action on it today.

Unfortunately the prospect is not very hopeful. In the first case, changes in Wobbe index (*i.e.*, in specific gravity) get past any device the wit of man has invented, though it is not inconceivable that some ingenious person might develop an orifice which varied in size according to the density of the gas passing through it. A thermostat is an effective way of overcoming Wobbe index changes, but is not always applicable and represents a considerable addition to the expense of the appliance and to the cost of maintenance.

As to the question of designing burners to prevent ill-effects due to drop in A.T.B. No., this can best be done by reducing the aeration of the burner. In most cases such reduction would necessarily involve lowering of either thermal efficiency or combustion standards. W. B. Kirk[16] has recently pointed out that to make a burner which will perform on both natural gas and manufactured gas, one must reduce aeration and increase flame-port area to about twice the normal figure. This is a change which would certainly not recommend itself to an appliance designer if he could avoid it, for it is a certain way of reducing the stability of the burner at turn-down when manufactured gas is used.

One can design a burner to take a wide variety of different gases, but only by a sacrifice of all-round efficiency.

Conclusions

Britain had not a great deal to be proud of in the gas quality situation as it existed prior to nationalisation. Most of the important European nations—Belgium, France, Switzerland, Germany, Holland—have standardised their calorific value while we had until recently some 26 separate grades. Pre-war Germany, which had a wide diversity of coal and of gas-making processes, had a code of practice framed by the industry itself which was revised from time to time to bring the limits closer. In 1939 a new code was drawn up to replace

the existing one, to which 80% of German gas production then conformed. The 1939 version laid down among other things :

Calorific value: between 4,200 and 4,600 cal./m³ = 440-485 B.Th.U./cu.ft.
Specific gravity: 0.4-0.5.
Ott No.: 60-100 (approx. = 33-44 on A.T.B. (B) scale).
Organic sulphur: not more than 25g/100m³.

No doubt if war had not intervened, these limits would have been narrowed down still further by now. Why cannot we have such a code in Britain ?

Perhaps now we can go further and gain some advantage from our backwardness. If the British industry could agree to adopt Wobbe index as the main criterion instead of calorific value, our service to the consumer would be greatly improved without any sacrifice of flexibility in gas works operation. Not only would the heat input to appliances be maintained constant, but, as has been shown, combustion characteristics would be stabilised, too.

Finally, all the gas produced in Britain should be made to fall into one or two, or at most three, categories—not of calorific value, but of Wobbe index. Our gas appliance makers would then be able to design their equipment with the certainty that the heat input in the customer's home would be neither more or less than was intended. The gas industry would have taken another step towards the provision of a fuel service which is clear, reliable and, at the same time, absolutely precise.

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MINOR CONSTITUENTS OF COAL

AT a joint meeting of the London and South-Eastern Section of the Royal Institute of Chemistry and the Woolwich Polytechnic Scientific Society, held at the Woolwich Polytechnic recently, a paper on 'The Minor Constituents of Coal,' summarised below, was presented by Dr. A. C. Monkhouse.

The organic material of coal is associated with varying amounts of inorganic matter derived from the mineral matter of the original coal-forming plants, from the shale, clay and pyrites of associated minerals, and from infiltered waters. Of the minor constituents of coal, nitrogen and sulphur are of primary economic importance.

The nitrogen content of British coals amounts to 1-2%, and is derived mainly from the proteins, &c., of the original plants. There is no definite knowledge yet of the nature of the nitrogen compounds in coal, but there are indications that part of the nitrogen is associated with a carbocyclic ring. On carbonising coal, the nitrogen is distributed among the products of distillation mainly as ammonia, pyridine, and hydrogen cyanide, but the greatest portion is left in the coke.

Sulphur Content

Sulphur in both organic and inorganic combination, ranges in British coals from 0.5-4%. During the war some 10,000 tons a year of iron pyrites in the form of lumps were recovered from the cleaning of coal. A further 25,000 tons were recovered as fines, equivalent in the total to 5% of the sulphuric acid industry's sulphur requirements. Oxides of sulphur, going to the atmosphere from the combustion of coal, amount to some 5 mill. tons a year, of which one-fifth comes from domestic appliances. Sulphur in coal is also responsible for the formation of deposits on the tubes of generators and superheaters in large boilers fired by mechanical stokers at power stations. The deposits consist of a matrix of sulphate and pyrosulphate, in which are embedded ash particles.

When coal is carbonised, the sulphur evolved as sulphuretted hydrogen is recovered in boxes containing iron oxide, and the spent oxide used for the manufacture of sulphuric acid. Organic sulphur compounds occur in the gas as carbon bisulphide, carbon oxysulphide and thiophene.

Phosphorus is an element in coal carrying from 0.001 to 0.1% and is associated with such mineral matter as phosphate, or as fluorapatite. Deposits containing 20% of phosphorus have been found in boiler systems. This has been due to the volatilisation of phosphorus compounds, particularly under reducing conditions and selective condensation. Phosphate deposits are difficult to remove.

Chlorine is present in coal from 0.01 to 1%, mainly as alkali chlorides. Certain coalfields have coals of high chlorine content, and the combustion of these coals in boilers can result in the formation of sulphatic deposits due to the volatilisation of the alkali chlorides and their subsequent reaction with oxides of sulphur. Chlorides have a deleterious effect on brickwork and may lead to disintegration of the walls of the retort or ovens.

Fluorine is present in coal to the extent of 5 to 200 parts per mill. usually with the mineral matter as fluorapatite. It may be found in products of coal carbonisation such as the tar and ammonia liquor, with corrosive effects; or in coal combustion gases with effect on products such as glass in annealing kilns, or the malt in direct drying kilns.

Arsenic, which occurs from 1 to 75 parts per mill., is important where coal is used for direct drying of food materials. It is associated with the sulphides in the mineral matter of coal.

'Trace' Elements in Coal

A considerable amount of work has been undertaken on 'trace' elements in coal, such as germanium. The late Dr. Goldschmidt, a pioneer in this field, attributed these trace elements to the soil in which the plants grew. Other examples are boron, zinc, gallium, and vanadium. Vanadium compounds occur in higher proportions in petroleum, and in jet, than in coal.

On distillation, many elements, found only as traces in original coal, are obtained in higher concentrations in the tar. As much as 0.04% of zinc has been found in tar. On combustion of coal in commercial plant these trace elements might become concentrated in some particular part of the flue system. A deposit on a boiler tube was found to have a boron content as high as 5%. Flue dust containing 0.55% of gallium has been found.

March 31, 1951, has been fixed by Coventry Corporation as the date on which provisions in the Coventry Corporation Act, 1948, relating to the establishment of a 30-acre smokeless zone in the city centre will come into operation. After that date, occupiers of premises in the area from which smoke is emitted will be liable on conviction to an initial penalty of up to £10 and a daily penalty not exceeding £5 while the offence continues. It is hoped gradually to extend the initial smokeless zone.